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RECEIVED

JUN 04 1984

MINN. POLLUTION
CONTROL AGENCY

June 1, 1984

Ms. Lisa Thorvig
Minnesota Pollution Control Agency
1935 West County Road B-2
Roseville, Minnesota 55113

Re: General Mills Hennepin Avenue Site

Dear Ms. Thorvig:

As agreed at our meeting on May 21, we are submitting logs for wells constructed for the groundwater investigation at the above referenced site and a cross section through the contaminant plume in the glacial drift.

Enclosed are logs for Shallow Drift Wells Q, R, S, T, U, V, W, X, Y, and Z; Carimona Wells 9, 10, 11, 12, and 13; and Magnolia Well ZZ. The locations of these wells are shown on the maps contained in the April 9, 1984 letter to Don Thimsen of General Mills, a copy of which I believe you have. Logs for the other wells installed in the site investigation are contained in our June, 1983 Site Characterization Study and Remedial Action Plan. Well construction data are summarized in Table 1 (bedrock wells) and in Table 2 (shallow drift wells) enclosed with this letter.

Cross Section B-B' (Figure 2) located as shown in Figure 1 illustrates the stratigraphy in the shallow glacial drift. Cross Section B-B' is drawn through the solvent plume in the glacial drift using Wells W, R, S, and J in the direction of groundwater movement. This cross section is an extension of Cross Section A-A' shown in our June, 1983 report. Cross Section A-A' was located through Wells 1, 2, 3, 4 and 5 in the shallow drift aquifer.

If there are any questions concerning the logs or the cross section, please contact me.

Sincerely,


Lawrence D. Dalen

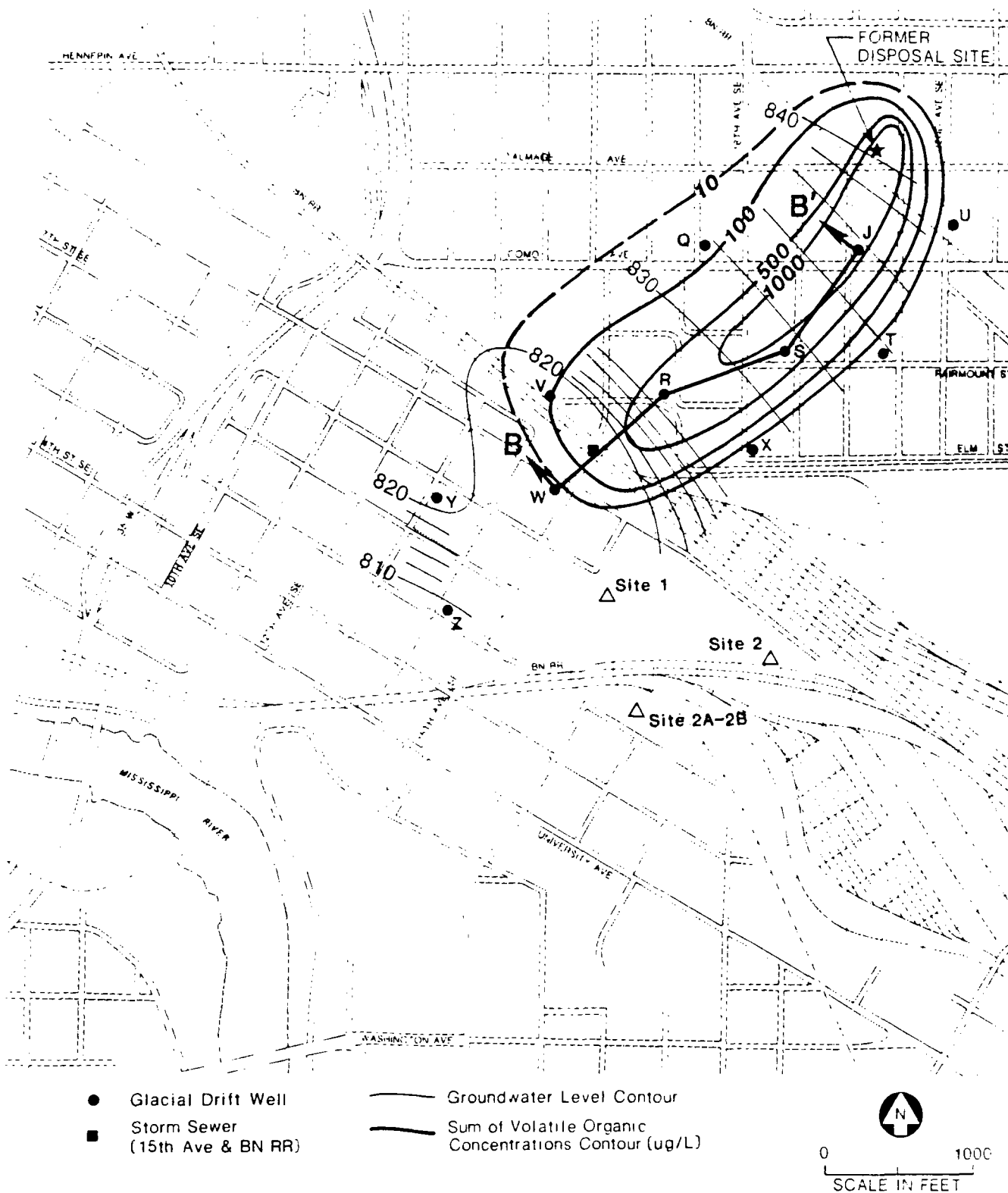
LDD/tmk
Enclosure
c: Don Thimsen

TABLE 1
WELL CONSTRUCTION DATA
BEDROCK PIEZOMETERS AND WELLS

ID No.	Borehole Diameter	Casing Diameter	Elevation, Top of Casing	Elevation, Ground Surface	Elevation, Top of Screen or Open Hole	Screen Length	Open Borehole Length	Elevation of Bottom of Screen or Open Hole	Elevation, Top of Sand Pack	Elevation, Bottom of Sand Pack	Elevation, Top of Carimona	Elevation, Carimona/Magnolia Contact	Formation/Member Completed In
BB	3"	1½"	864.61	862.7	797.8	5	-	792.8	802.7	792.5	802.7	798.7	Car./Mag.
GG	3"	1½"	856.21	854.9	795.9	10	-	785.9	800.9	785.9	802.4	798.9	Car./Mag.
II	3"	2"	856.18	854.9	800.0	10	-	790.0	802.7	787.6	802.2	798.2	Car./Mag.
LL	3"	1½"	852.24	851.5	797.2	2	-	795.2	802.5	787.1	802.5	798.5	Car./Mag.
OO	3"	1½"	850.07	849.5	791.1	2	-	789.1	794.0	786.0	801.3	797.5	Magnolia
PP	3"	1½"	850.28	849.3	796.3	2	-	794.3	801.6	786.2	801.3	797.3	Car./Mag.
QQ	3"	1½"	849.01	848.3	791.0	2	-	789.0	795.8	782.7	797.8	796.5	Magnolia
RR	4"	1½"	849.97	849.4	799.0	2	-	797.0	801.1	796.4	801.2	798.2	Carimona
SS	6"	2"	861.70	859.7	801.8	2	-	799.8	804.1	799.1	803.6	799.0	Carimona
TT	6"	2"	861.94	859.6	792.7	2	-	790.7	795.3	788.9	803.6	799.6	Magnolia
UU	6"	2"	863.98	862.4	802.6	2	-	800.6	804.8	783.4	805.2	800.4	Car./Mag.
VV	6"	2"	859.09	856.8	790.6	2	-	788.6	793.2	784.2	800.8	797.0	Magnolia
WW	6"	2"	857.76	856.4	799.3	2	-	797.3	802.1	797.1	800.8	797.0	Carimona
ZZ	4"	4"	850.25	847.3	795.8	-	5.0	790.8	-	-	800.2	796.6	Magnolia
8	4"	4"	860.36	858.6	800.6	-	3.6	797.0	-	-	800.6	797.0	Carimona
9	4"	4"	862.48	860.5	803.3	-	4.0	799.3	-	-	803.3	798.6	Carimona
10	4"	4"	860.39	858.4	799.4	-	3.0	796.4	-	-	800.0	796.0	Carimona
11	4"	4"	852.84	850.2	802.2	-	5.7	798.2	-	-	802.2	797.7	Carimona
12	4"	4"	861.10	858.6	802.6	-	5.5	797.1	-	-	802.6	798.6	Carimona
13	4"	4"	849.25	847.2	801.7	-	4.5	797.7	-	-	802.2	796.6	Carimona
108	6"	6"	860.58	858.3	802.3	-	3.5	798.8	-	-	802.3	798.1	Carimona

TABLE 2
WELL CONSTRUCTION DATA
SHALLOW WELLS AND PIEZOMETERS

<u>ID No.</u>	<u>Elevation, Top of Casing</u>	<u>Elevation, Ground Surface</u>	<u>Casing Diameter (in)</u>	<u>Screen Length (ft)</u>	<u>Elevation, of Top of Screen</u>	<u>Elevation, of Bottom of Screen</u>
A	860.00	858.0	2	10	855.5	845.4
B	864.28	861.5	2	10	844.9	834.9
C	865.00	863.1	2	10	846.6	836.6
D	857.24	855.2	2	10	844.2	834.2
E	860.80	858.8	2	10	842.3	832.3
F	865.34	863.3	2	10	840.3	830.3
G	856.30	854.3	2	10	840.8	830.8
H	857.39	855.4	2	10	840.4	830.4
K	852.43	851.4	1½	2	831.4	829.4
L	852.21	851.4	1½	2	831.2	829.2
M	851.18	850.6	1½	2	828.2	826.2
N	849.47	848.7	1½	2	826.5	824.5
J	851.85	851.0	1½	2	828.9	826.9
P	850.37	849.5	1½	2	828.0	826.0
Q	850.38	848.3	2	10	834.4	824.4
R	843.19	841.3	2	10	831.8	821.8
S	843.15	846.3	2	10	831.8	821.8
T	849.36	847.3	2	10	835.3	825.3
U	854.50	852.5	2	10	841.3	831.3
V	838.59	837.0	2	10	821.4	811.4
W	830.78	829.2	2	10	822.1	812.1
X	842.90	840.8	2	10	831.8	821.8
Y	835.69	833.8	2	10	821.5	811.5
Z	833.23	831.3	2	10	812.4	802.4
1	864.04	861.4	4	10	843.4	833.4
2	857.21	854.0	4	10	838.0	828.0
3	853.64	851.7	5	10	838.2	828.2
4	851.23	849.3	5	10	836.3	826.3
5	849.46	847.7	5	10	833.7	823.7
106	861.20	858.4	2	5	838.4	833.4
107	860.10	858.2	6	5	824.2	819.2

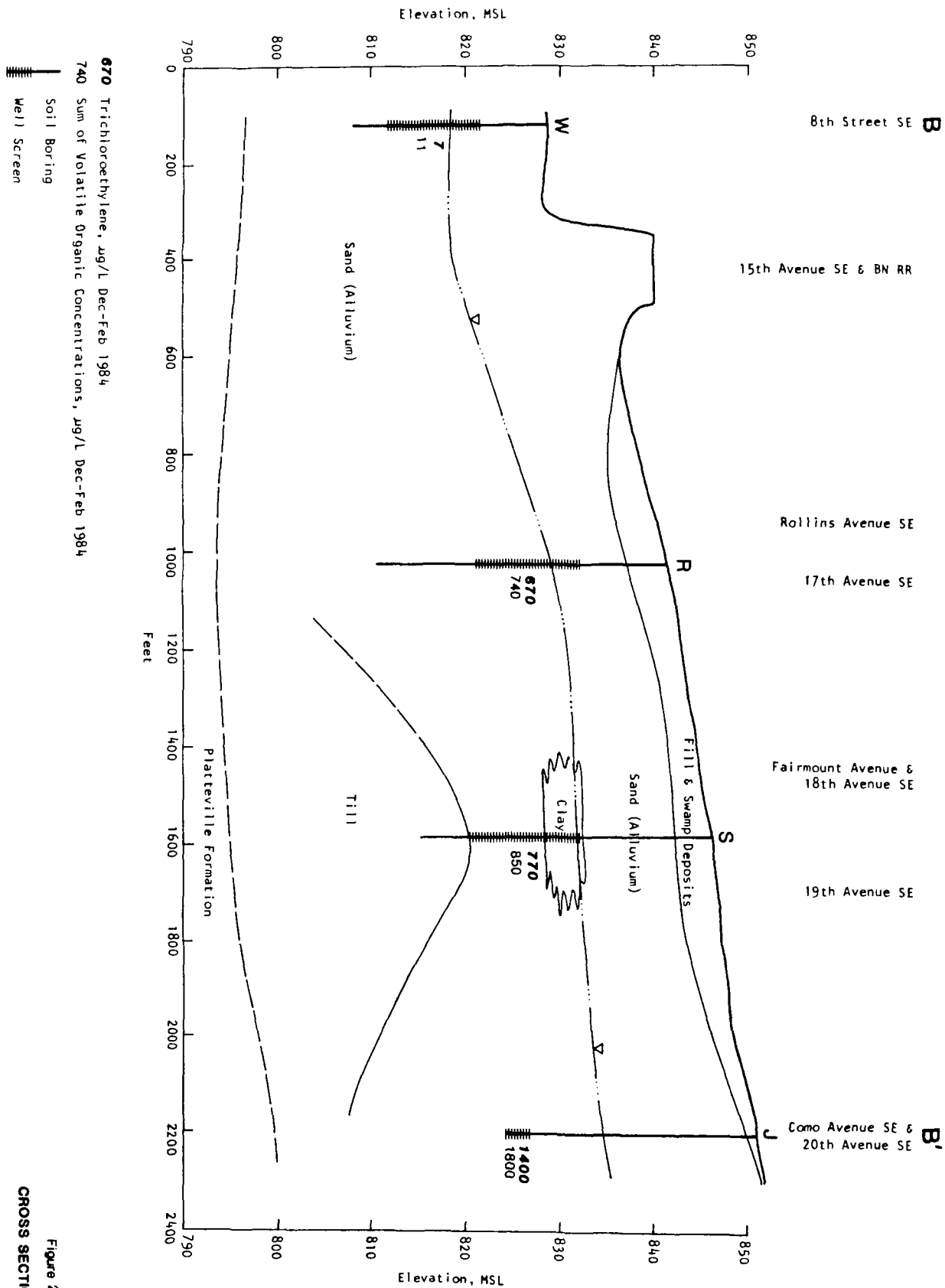


	Water El. (MSL) March 28, 1984	Sum of Volatile Organic Concentrations (ug/L)
Q	832.1	56
R	829.2	740
S	831.2	850
T	833.9	<1
U	838.9	1.3
V	818.1	100
W	819.3	11
X	829.0	2.2
Y	821.2	BMDL
Z	810.0	BMDL
Storm Sewer 15th Ave. & BNRR	816	6.4

BMDL means below detection limit

Figure 1

SHALLOW GLACIAL DRIFT AQUIFER LEVELS & QUALITY



REPORT OF TEST BORINGS
GENERAL MILLS
WASTE DISPOSAL SITE
MINNEAPOLIS, MINNESOTA

GEC JOB NO: 3544

November 11, 1983

GEO-TECHNICAL ENGINEERING CORPORATION



1925 Oakcrest Avenue • Roseville, Minnesota 55113 • (612) 636-7744

November 11, 1983

Barr Engineering
6800 France Avenue South
Minneapolis, Minnesota 55435

Re: Test Borings
General Mills, Waste Disposal Site
Minneapolis, Minnesota

GEC Job No. 3544

The report of the test borings we drilled at the referenced site is attached.

Please call if you have any questions regarding this report.

Very truly yours,

A handwritten signature in cursive script, reading "Robert E. Pendergast".

Robert E. Pendergast, P.E.
President

REP/ck

enc.

REPORT OF TEST BORINGS
GENERAL MILLS
WASTE DISPOSAL SITE
MINNEAPOLIS, MINNESOTA
GEC JOB NO: 3544

During the period of October 6 - November 2, 1983, we drilled six test borings for the referenced project.

The borings were made at locations selected by Barr Engineering.

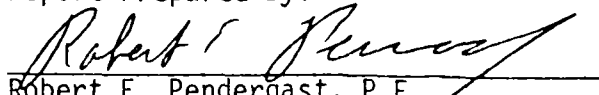
The borings were made using the standard penetration - split spoon and coring methods. Refer to the attached sheets (Drilling, Sampling and Testing; Test Boring and Logging Methods) for additional information regarding test boring methods.

The soils were classified in accordance with the ASTM Visual-Manual Method (ASTM D 2488). Refer to the attached sheet (Unified Soil Classification System) for a description of the classification method.

Refer to the attached logs for a description of the subsurface conditions encountered in the borings. The logs show: the depths to the boundaries between the soil layers; the description, classification, and geologic identification of the soils; water level measurements; standard penetration resistance (N column, in blows per 1/2 foot); and other information. Refer to the attached sheets (Drilling, Sampling and Testing; Test Boring and Logging Methods; Geologic Terminology; Groundwater) for a description of terminology used on the logs.

To protect the addressee, the public, and ourselves, this report (and all supporting information) is provided for the addressee's own use. No representations are made to parties other than the addressee.

Report Prepared By:


Robert E. Pendergast, P.E.
MN Reg. No. 8450

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1" = 3'

LOG OF BORING NO. 9 (P. 1 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, IN FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TEST			
							MC	DEN	LL PL	
1	SILTY SAND, fine grained, with a trace of gravel, black, **	UNCONTROLLED FILL		N	HSA		*Blows per 1/2' **(nonplastic-SM)			
2	SILTY SAND, fine grained, with a trace of gravel, dark brown, (nonplastic-SM)			N	HSA					
3										
4										
5		SWAMP DEPOSITS or ALLUVIUM	3	N	SS	18	**See attached sheet for additional measurements.			
6			3							
7			3							
8	MARL, white to tan									
9		COARSE ALLUVIUM	2	Y	SS	18				
10			18"							
11										
12										
13		COARSE ALLUVIUM	5							
14			3	Y	SS	12				
15	SILTY SAND, fine grained, brown, (SP-SM)		5							
16										
17		COARSE ALLUVIUM	3							
18			1	Y	SS	8				
19	SAND, fine to medium grained, with a trace of gravel, brown, (SP)		4							
20										
21										

DEPTH	DRILLING METHOD	WATER LEVEL MEASUREMENTS **							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL	
0-43½	HSA								
19½-46	RD /DM								
0-54½	N-casing	10/6	11:29	16	14½	14.3		dry	
		10/6	11:37	16	19½	10.7		10.3	
BORING COMPLETED: 10/11/83 4:30		10/6	11:56	16	19½	10.8		10.3	
CC: DO Dir: SB Rig: 55		10/7	10:24	48.7	44.7	?		4.5	

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO. 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO: 9 (P. 2 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

PROJECT: _____										
DEPTH. in FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.L.	
22 -	SAND, medium grained, with some gravel, brown, (SP)	COARSE ALLUVIUM	12 7 8	Y	SS	8	*Blows per 1/2'			
23 -										
24 -										
25 -										
26 -										
27 -	SILTY SAND, with some gravel, brown, (SP-SM)	COARSE ALLUVIUM	10 14 14	Y	SS	5				
28 -										
29 -										
30 -										
31 -										
32 -	SAND, with a trace of gravel, brown, (SP)	COARSE ALLUVIUM	11 20 24	Y	SS	8				
33 -										
34 -										
35 -										
36 -										
37 -	SANDY CLAY, with a little gravel, gray, (CL)	GLACIAL TILL	12 22 17	?	SS	12				
38 -										
39 -										
40 -										
41 -										
42 -	SHALE, bluish green to gray, (CH)	BEDROCK (DECORAH SHALE FORMATION)	12 16 15	?	SS	15				
43 -										
44 -										
45 -										
46 -										
47 -					N Core	57%				

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO. 9 (P. 3 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, in FEET	DESCRIPTION AND CLASSIFICATION	GEOLOGY	N	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	LL PL	
48 -	-----SAME AS ABOVE -----				N Core	0%*				
49 -										
50 -					N Core	0%*				
51 -										
52 -					** Core					
53 -										
54 -	Limestone				N Core	100%				
55 -										
56 -										
57 -	Shale, dark gray	BEDROCK (PLATTEVILLE FORMATION)			N Core	100%				
58 -	Limestone, fine grained, light gray, bentonite lense at 60.3' Carimona Member									
59 -										
60 -										
61 -										
62 -	Dolomite Limestone, fine grained, *				N Core	100%				
63 -	END OF BORING									
64 -										
65 -	Cement grout - 0-57'									
66 -	Bentonite pellet seal 57' - 62.5'									
67 -										
68 -										
69 -										
70 -										
71 -										
72 -										
73 -										

*Split Spoon Sample taken of lost core: 5" recovery

*Split Spoon sample taken of lost core: 15" recovery

**RD+Water 52.5-54.5'

Lost water circulation at 54'

Loss of water at 61.1 *light gray to buff, Magnolia Member

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1" = 3'

LOG OF BORING NO. 10

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, IN FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	LL PL	
1	SILTY SAND, fine grained, with a little gravel, black, (slightly plastic-SM)	UNCONTROLLED FILL		N	HSA		*Blows per 1/2'			
2				N	HSA					
3	SILTY SAND, fine to medium grained, with a little gravel, dark brown to black, (nonplastic-SM)									
4										
5	SILTY SAND, fine grained, buff, (nonplastic-SM)	FINE ALLUVIUM	5	N	SS	10				
6			5							
7			6							
8										
9	SILTY SAND, fine grained, light brown to buff, (nonplastic-SM)	FINE ALLUVIUM	3	N	SS	15				
10			5							
11			5							
12										
13		COARSE ALLUVIUM								
14										
15	SILTY SAND, well graded, with gravel, dark reddish brown, (nonplastic-SM)		23	Y	SS	15				
16			25							
17			30							
18										
19										
20	END OF BORING									
21	Auger obstructed (crooked HSA) Soil Fill: 0-20'									

DEPTH : DRILLING METHOD		WATER LEVEL MEASUREMENTS					
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
0- 19½: 4¼" HSA							
14½-15 RD/DM		10/12	10:20	16	14½	14.4	13.4
BORING COMPLETED: 10/12/83 4:12							
CC: DO Dir: SB Rig: 55							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO: 10A (P. 2 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, in FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.L.	
22-										
23-										*Blows per 1/2'
24-	CLAYEY SAND, fine grained, with a trace of gravel, gray, (SC)		40							
25-			52	?	SS	13				
26-			48/5"							
27-										
28-		COARSE ALLUVIUM								
29-										
30-	SILTY SAND, fine to medium grained, with gravel, (non- plastic-SM)		50							
31-			50/5"	?	SS	8				
32-										
33-										
34-		TUMBLEROCK								
35-	CLAY, with some gravel, bluish gray, (CH) (Mixture of gravel and "reworked shale")		31							
36-			69/5"	?	SS	7				
37-										
38-										
39-										
40-										
41-				28						
42-		CLAY, bluish gray, (CL)	28	?	SS	12				
43-	SHALE, bluish gray, (CH)	BEDROCK (DECORAH SHALE)	43							
44-			41	?	SS	8				
45-			51							
46-										
47-						B Core	85%			

*Blows per 1/2'

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO. 10A (P. 3 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

[illegible]

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1" = 3'

LOG OF BORING NO. 11 (P. 1 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

PROJECT: _____											
DEPTH, IN FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS				
							MC	DEN	LL PL		
1 -	SANDY SILT, with a trace of gravel, black, (plastic-ML)	FILL		N	HSA					*Blows per 1/2'	
2 -											
3 -	SANDY SILT, with a trace of gravel, black, (nonplastic-ML)										
4 -											
5 -	SANDY SILT, black, (nonplastic -OL)	TOPSOIL	8								
6 -	SAND, fine grained, buff, (SP-SM)	COARSE ALLUVIUM	7	N	SS	12					
7 -			8								
8 -											
9 -											
10 -	SAND, fine grained, light brown, (SP)		6								
11 -			6	N	SS	12					
12 -			8								
13 -											
14 -	SILTY SAND, well graded, with gravel, reddish brown, (SW-SM)		16								
15 -			15	Y	SS	11					
16 -			16								
17 -											
18 -											
19 -	GRAVEL & SAND, gray, (GP)										
20 -			14								
21 -			10	Y	SS*	6				*Material recovered might be wash	
		7									

DEPTH : DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-19	4 1/4" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL	
19-46:	RD/DM								
0-46:	N Casing	10/20	12:46	14.1	15	14.4		wet	
		10/24	8:37	49.2	45.7	49.2		wet	
BORING COMPLETED:	10/24/83 12:10	10/24	10:16	53.6	45.7	53.6			
CC:	DO Dir: SB Rig: 55								

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO: 11 (P. 2 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH in FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.C.	
22-										*Blows per 1/2'
23-										
24-			12							
25-			12	Y	SS *	2				*Material recovered
26-			12							might be wash
27-										
28-										
29-	SAND, medium grained, with a trace of gravel, brown, (SP)	COARSE ALLUVIUM								
30-			26							
31-			39	Y	SS	11				
32-			36							
33-										
34-	SHALE, bluish gray, (CH)	BEDROCK (DECORAH SHALE)	11							
35-			24	N	SS	6				
36-			31							
37-										
38-										
39-										
40-			18							
41-			35	N	SS	7				
42-			47							
43-										
44-										
45-										
46-	LIMESTONE, fine grained, gray.	BEDROCK								Material in core box for 45½ - 49' run is not in order.
47-					N Core	84%				

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO. 11 (P. 3 of 3)

PROJECT: GENERAL MILLS

PROJECT										
DEPTH, in FEET	DESCRIPTION AND CLASSIFICATION	GEOLOGY	N	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	$\frac{LL}{PL}$	
48 -	Lense of Bentonite @ 50.5'	BEDROCK (PLATTEVILLE FORMATION)			N	84%	Loss of water at 50.3			
49 -					Core					
50 -										
51 -	N	95%								
52 -	Dolomitic LIMESTONE, gray				Core					
53 -	Magnolia member									
54 -	END OF BORING									
55 -	Cement grout at 0-50' Bentonite Pellet Seal: 50-53.6'									
56 -										
57 -										
58 -										
59 -										
60 -										
61 -										
62 -										
63 -										
64 -										
65 -										
66 -										
67 -										
68 -										
69 -										
70 -										
71 -										
72 -										
73 -										

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1" = 3'

LOG OF BORING NO. 12 (p. 1 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH. IN FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N *	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.L.	
1- 2- 3- 4- 5- 6- 7-	SANDY SILT, with a little gravel, black, (plastic-ML) SILT, with a trace of gravel, gray, black and brown, contains a little sand, (plastic-ML)	UNCONTROLLED FILL		N	HSA					*Blows per 1/2'
2- 3- 4-			2 2 3	N	SS	15				
8- 9- 10- 11- 12- 13-	ORGANIC SILT, dark gray, contains shell fragments, (OL)	SWAMP DEPOSITS	2 3 4	?	SS	15				
14- 15- 16- 17-	SILTY SAND, fine grained, light brown, (SP-SM)		5 9 11	N	SS	14				
18- 19- 20- 21-	SILTY SAND, with gravel, brown, (nonplastic-SM)	COARSE ALLUVIUM	25 32 36	Y N	SS	11				**See attached sheet for additional measurements.

DEPTH :	DRILLING METHOD	WATER LEVEL MEASUREMENTS **						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL
0-29:	4 1/4" HSA							
24 1/2-51.8:	RD/DM	10/28	12:00	21	19 1/2	19.7		18.9
0-52.5:	N Casing	10/28	12:55	21	19 1/2	19.6		18.5
BORING COMPLETED:	11/2/83 3:37	10/31	10:35	26	27	23.5		17.8
CC:	DO Dir: SB Rig: 55	11/1	1:23	54.7	52 1/2	48.5		24.7

NOTE: REFER TO
THE ATTACHED
SHEETS FOR AN
EXPLANATION OF
TERMINOLOGY
ON THIS LOG

Revised 12/1/83
EK

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO: 12 (p. 2 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, in FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.L.	
22 -										
23 -										
24 -										
25 -			21 -	Y	SS*	6				
26 -			50/4"							
27 -	GRAVEL*, gray, (GP)									
28 -										
29 -										
30 -		COARSE ALLUVIUM								
31 -			50	Y	SS	7				
32 -	SILTY SAND, fine grained, with a trace of gravel, grayish brown, (nonplastic-SM)		52							
33 -			18/2"							
34 -										
35 -										
36 -			28	Y	SS	8				
37 -			52							
38 -			20/3"							
39 -										
40 -										
41 -			36	Y	SS	7				
42 -			50							
43 -			14/3"							
44 -										
45 -										
46 -			22	Y	SS	12				
47 -			24							
			28							

*Blows per 1/2'

*Material recovered
might be wash.

Revised 12/1/83

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1" = 3'

LOG OF BORING NO. 12 (p. 1 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, IN FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N *	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TEST:			
							MC	DEN	L.L. P.L.	
1 -	SANDY SILT, with a little gravel, black, (plastic-ML)	UNCONTROLLED FILL		N	HSA					*Blows per 1/2'
2 -										
3 -										
4 -	SILT, with a trace of gravel, gray, black and brown, contains a little sand, (plastic-ML)		2							
5 -			2	N	SS	15				
6 -			3							
7 -										
8 -	ORGANIC SILT, dark gray, contains shell fragments, (OL)	SWAMP DEPOSITS								
9 -										
10 -			2							
11 -			3	?	SS	15				
12 -			4							
13 -										
14 -	SILTY SAND, fine grained, light brown, (SP-SM)		5							
15 -			9	N	SS	14				
16 -			11							
17 -										
18 -		COARSE ALLUVIUM								**See attached sheet for additional measurements.
19 -	SILTY SAND, with gravel, brown, (nonplastic-SM)									
20 -			25	Y						
21 -			32	N	SS	11				
			36							

DEPTH	DRILLING METHOD	WATER LEVEL MEASUREMENTS **							
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL	
0-29: 4 1/4" HSA									NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
24 1/2-51.8: RD/DM		10/28	12:00	21	19 1/2	19.7		18.9	
0-52.5: N Casing		10/28	12:55	21	19 1/2	19.6		18.5	
BORING COMPLETED: 11/2/83 3:37		10/31	10:35	26	27	23.5		7.8	
CC: D0 Dir: SB Rig: 55		11/1	1:23	54.7	52 1/2	48.5		4.7	

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO: 12 (p. 2 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, in FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.L.	
22 -										
23 -										
24 -										
25 -										
26 -			21	Y	SS*	6				*Blows per 1/2'
27 -	GRAVEL*, gray, (GP)									
28 -										
29 -										
30 -		COARSE ALLUVIUM								
31 -			50	Y	SS	7				
32 -	SILTY SAND, fine grained, with a trace of gravel, grayish brown, (nonplastic-SM)		52							
33 -			18	2"						*Material recovered might be wash.
34 -										
35 -										
36 -			28	Y	SS	8				
37 -			52							
38 -			20	3"						
39 -										
40 -										
41 -			36	Y	SS	7				
42 -			50							
43 -			14	3"						
44 -										
45 -										
46 -			22	Y	SS	12				
47 -			24							
			28							

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO.

12 (p. 3 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

[illegible]

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1" = 3'

LOG OF BORING NO. 108 (p. 1 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH, IN FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	L.L. P.L.	
1- 2- 3- 4- 5- 6- 7- 8-	SILTY SAND, fine grained, with a trace of gravel, black, contains pieces of glass, (nonplastic-SM)	UNCONTROLLED FILL	2 1 2	N	SS	4				*Blows per 1/2'
9- 10- 11- 12- 13-	SILTY SAND, fine grained, gray, (SP-SM)	COARSE ALLUVIUM	4 4 4	N	SS	16				
14- 15- 16- 17- 18-	SILTY SAND, very fine grained, gray, (SP-SM)		8 11 14	N	SS	16				
19- 20- 21-	SILTY SAND, fine grained, brown, (SP-SM)		6 8 8	Y	SS	15				

DEPTH : DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL	
0-24:	4 1/4" HSA								
24-54:	RD/DM	10/24	3:42	21 1/2	24	22		8	
0-54:	N Casing	10/25	9:45	26 1/2	24	24.8		10.3	
BORING COMPLETED:	10/26/83 4:59	10/25	3:51	58.90	54.0	58.5		28.4	
CC:	DO Dir: SB Rig: 55	10/26	11:49	61.45	54.0	60.8		29.1	
		10/26	2:08	61.45	54.0	60.8		29.4	

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO: 108 (p. 2 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

DEPTH. in FEET	SURFACE ELEVATION: _____ DESCRIPTION AND CLASSIFICATION	GEOLOGY	N*	WB	SAMPLE TYPE	REC.	FIELD & LABORATORY TESTS			
							MC	DEN	LL PL	
22-										
23-										
24-										
25-	SILTY SAND, fine grained, brown, (SP-SM)		13							
26-			16	Y	SS	6				
27-			13							
28-										
29-										
30-	SAND, fine to medium grained, with a trace of gravel, brown, (SP)	COARSE ALLUVIUM	9							
31-			16	Y	SS	10				
32-			20							
33-										
34-										
35-										
36-			11							
37-			11	Y	SS	10				
38-			10							
39-										
40-										
41-	SANDY CLAY, with a trace of gravel, grayish brown, (CL)	GLACIAL TILL	9							
42-			11	?	SS	16				
43-			16							
44-										
45-										
46-										
47-			12							
			19	?	SS	8				
			20							

*Blows per 1/2'

GEOTECHNICAL ENGINEERING CORPORATION

GEC JOB NO: 3544

VERTICAL SCALE: 1"=3'

LOG OF BORING NO. 108 (p. 3 of 3)

PROJECT: GENERAL MILLS, WASTE DISPOSAL SITE, MINNEAPOLIS, MINNESOTA

[illegible]

ADDITIONAL WATER LEVEL READINGS

<u>DATE</u>	<u>TIME</u>	<u>SAMPLED DEPTH</u>	<u>CASING DEPTH</u>	<u>CAVE-IN DEPTH</u>	<u>DRILLING MUD LEVEL</u>	<u>WATER LEVEL</u>
<u>Boring #9</u>						
10/7	11:15	51.5	44.7	48.0		0.4
10/7	1:02	51.5	44.7	47.9		
10/7	3:05	52.0	44.7	39.2		9.1
10/10	8:31	52.5	49	24.6		14.4
10/11	11:32	59.5	54.4	59.2		14.0
10/11	1:27	62.5	54.4	62.2		31.9

Boring #12

11/2	10:29	61.5	52.5	60		10.5
11/2	12:36	61.5	52.5	60		13.2

TEST BORING AND LOGGING METHODS

STANDARD PENETRATION - SPLIT SPOON TEST

A 1-3/8" ID, 2" OD steel sampling tube is driven into the soil with a 140 pound weight falling 30". The number of hammer blows required to drive the sampler 1', after an initial set of 1/2', is the standard penetration test ("N" value).

The bore hole is advanced between sampling intervals with flite auger, hollow stem auger, casing, or by rotary drilling.

AUGER BORINGS

Auger borings are drilled by hand or with a power-driven auger.

The hand auger method consists of drilling the auger into the soil in increments of approximately 4", then retracting the auger and observing the material recovered. This allows almost continuous observation of the soil profile.

Two procedures are available in drilling power auger borings: "spinning" and "pulling". In the spinning procedure, the auger is drilled into the ground in increments of 5', or less. The auger is then spun rapidly. Soil "rides up" the auger to the ground surface where samples are then taken. In general, this method results in reasonably accurate identification of the soil profile above the groundwater table, but can be very misleading - particularly in sandy and gravelly soils - below the water table. In the pulling procedure, the auger is drilled into the ground and then retracted to above the ground surface. The general soil profile can be observed and samples of materials adhering to the auger are taken. In general, this method is considered to be a little more accurate than the spinning method in soil above the groundwater table, and considerably more accurate than the spinning method in soil below the groundwater table.

THIN WALL TUBE SAMPLES

Comparatively undisturbed samples are taken with thin wall tubes which are pushed into the soil.

STATIC CONE TESTS

The static cone test consists of measuring the force required to push a steel cone penetrometer into soil. Cone diameters are 1-3/4", 2-1/4", and 3". The apex angle is 60°. The cone is pushed at a rate of approximately 1/2" per second. A hand cone penetrometer also is used. It has a 30° apex angle and a projected end area of 0.5 square inches. The static cone bearing pressure, q_c , is the total load divided by the projected end area of the cone.

CORING

Coring is done with a diamond or carbide bit on a double tubed barrel.

TEST BORING & LOGGING METHODSLOGGING

Both factual data and interpretative information is included on boring logs.

In general, the information on the righthand side and the bottom of a log is considered to be essentially factual data.

In the "Description and Classification" and "Geology" columns, the intent is to portray the soil profile, or stratigraphy, based on interpretation of available data. Since the information shown is interpretive, it is subject to error. The accuracy of the information shown is controlled by the type and amount of data available. In general, there are three basic categories of information shown: 1) the description and classification of material recovered and observed; 2) the depths of the contacts between soil layers; and, 3) the geologic classification of the soils. Comments regarding these items follow: 1) The completeness of the description and classification of soils depends on the description and classification method used and the quality of the samples recovered. 2) Determination of depths to contacts between soil layers is arrived at by taking into consideration the action of the drill tools and the appearance of materials recovered. On a given boring log, contacts shown with solid and dashed lines are used to indicate higher and lower accuracy, respectively. In general, the entire soil profile is not observed or sampled. Consequently, indicated depths of contacts may be incorrect, and some materials or layers may be undetected in a boring and may not be described, identified, or in any way indicated on a boring log. 3) The indicated geology of the soil is interpretive, the accuracy of which is dependent on the judgment of the classifier.

Boulders and other large objects generally are not recovered from test borings. This is due to limitations on the size of particles that can be recovered. Though there may be no specific reference to such materials on boring logs or in a report, they may be present in the ground. This is particularly applicable to deposits such as coarse alluvium, uncontrolled fill, glacial till, outwash, tumblerock, and weathered bedrock.

Typewritten logs are prepared based on field logs. A field log may contain interpretive information - such as notes regarding unusual drilling conditions - which is not indicated on the typewritten log.

TERMINOLOGY ON BORING LOGS:
DRILLING, SAMPLING, AND TESTING NOTATION
(Refer to attached sheets for additional information.)

A,B,N,H:	Size casing or core.
AC:	At completion of boring.
CAS:	Casing.
CONS:	One dimensional consolidation test.
COT:	Clean out tube.
DEN:	Dry density, pounds/cubic foot.
DM:	Drilling mud.
FA:	Flite auger, power driven. P-pull; S-spin.
HA:	Hand auger.
HSA:	Hollow stem auger.
HYD:	Hydrometer analysis.
LL:	Liquid limit.
MC:	Moisture content, percent of dry weight.
N:	Standard penetration test, penetration resistance, or N value, blows/foot.
PAP:	Paper plug.
PL:	Plastic limit.
q _p :	Pocket Penetrometer strength, tons/square foot.
q _c :	Static cone bearing pressure, tons/square foot.
q _u :	Unconfined compressive strength, tons/square foot.
RD:	Rotary drilling, using drilling fluid and a cone-type roller bit.
REC:	In split spoon and thin wall tube sampling, the length of sample recovered, in inches. In rock coring, the length of core recovered as a percentage of the total core run.
REV:	Revert drilling fluid.
SA:	Sieve analysis.
SS:	Standard split spoon sampler. Steel, 1-3/8" inside diam.; 2" outside diam.
TW:	Thin wall tube sampler.
VANE:	Vane shear strength, tons/square foot. L - Laboratory; F - Field.
WASH:	Sample recovered from drilling fluid.
WAT:	Water.
WB:	Describes whether the sample appears to be waterbearing.
WH:	Sampler advanced by static weight of drill rod and 140 lb. hammer.
WR:	Sampler advanced by static weight of AW size drill rod.
-200:	Amount of material finer than #200 sieve, percent.
▼:	Water level symbol.

Note: The size of equipment is indicated by a number preceding the descriptive term. For example, 2-1/2 CAS represents 2-1/2" diameter casing.

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			HIGHLY ORGANIC SOILS		

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION SYSTEM

GEOLOGIC TERMINOLOGY

The geologic description indicates the apparent depositional origin or stratigraphic name. Geologic identification is interpretive and subject to error.

General categories of geologic deposits and descriptive information is as follows:

ALLUVIUM	COARSE ALLUVIUM:	Sandy (and gravelly). Stratified. Deposited from fast moving waters in streams, rivers, and deltas.
	FINE ALLUVIUM:	Clayey and/or silty. Stratified. Deposited from slow moving waters in streams, rivers, and lakes.
BEDROCK		Wide range of characteristics, from a hard, dense, consolidated rock to soft, compressible, and unconsolidated soil-like material.
FILL	CONTROLLED:	Compact, uniform material; inorganic; no debris.
	UNCONTROLLED:	Loose or variable density. Mixture of soil types. Often contains debris and organic material.
GLACIAL TILL		Sandy/silty/clayey. Normally contains a wide range of grain sizes, from clay through boulders. Usually non-stratified. Deposited directly from glaciers.
LAKE DEPOSIT		Clayey. Laminated. Deposited from very slow moving waters in ponds and lakes.
LOESS		Silty. Non-stratified. Upper layer. Deposited from wind.
OUTWASH		Coarse alluvium deposited from glacial meltwaters.
SLOPEWASH		Organic and/or inorganic material. Washed from slopes and deposited in depressions.
SWAMP DEPOSIT		Peat, muck, marl. Formed through accumulation of organic material under water.
TOPSOIL		Contains both inorganic and organic material. Upper, black layer of soil. Formed by weathering of inorganic soil and accumulation of organic material.
TUMBLEROCK		Dominantly gravel, boulders and rock slabs. Deposited from gravity flow down hills or cliffs.
WEATHERED BEDROCK		Bedrock which has been substantially weathered through disintegration or decomposition.
WEATHERED SOIL		Texture and composition is transitional between topsoil and underlying non-weathered soil.


TERMINOLOGY ON BORING LOGS

GROUNDWATER

Groundwater information is shown in two places on logs: 1) under "Water Level Measurements" and 2) in the "WB" column.

Information under Water Level Measurements includes: 1) The depth to the water level (or drilling mud, if used) and the depth to the bottom of the hole (cave-in). Water level and cave-in measurements are taken with a weighted measuring tape. If free-standing water is not encountered in the hole, the term wet, or dry, is indicated under water level. This means that the soil adhering to the end of the measuring tape did, or did not, respectively, appear to be saturated. 2) The depth sampled and the depth of casing (or hollow-stem auger) for measurements made during the progress of the boring. 3) Date and time of measurements.

Notation in the WB column describes whether soil samples appear to be water-bearing or saturated. Y means yes, N means no, and ? means questionable or indefinite.

The water level symbol  in the WB column indicates the apparent depth to the groundwater table at the bore hole. Determination of the depth to the groundwater table is an interpretive process. The determination is based on various factors, including: water level measurements, the appearance of samples, overall subsurface conditions, site conditions and weather conditions. The accuracy of the indicated depth to the groundwater table can be quite variable. The water level symbol with an arrow pointed downward (or upward) indicates that the water level is at or below (or above) the level indicated. Absence of the water level symbol does not necessarily mean groundwater was not encountered, or that the water table or piezometric surface was not penetrated.

The presence of groundwater in the soil and the level of the groundwater table can change with time. The information in the WB column is based on observations and measurements made at the time the boring was drilled and water level measurements were taken.

COPY



SOIL EXPLORATION
company

662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612.645-6446

February 17, 1984

a sister corporation to TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Barr Engineering Company
6800 France Avenue South
Minneapolis, MN 55435

Attn: Mr. Lawrence Dalen

Subject: Soil Borings & Monitoring Well Installations
General Mills Minneapolis Site
Minneapolis, Minnesota
#120-11331

OFFICERS:
CHARLES W. BRITZIUS
chairman of the board
NORMAN E. HENNING
president
ROBERT F. WITTMAN
executive vice president
CLINTON R. EUE
secretary/treasurer

HOME OFFICE:
ST. PAUL, MN

OFFICES IN:
MANKATO, MN
ROCHESTER, MN
WAITE PARK, MN

Gentlemen:

We have completed the soil borings and monitoring well installations for the above referenced project. This work was conducted in accordance with authorization we received on January 27, 1984.

As you requested, all samples obtained in the borings will be delivered to your office.

The test borings and monitoring well installations were conducted during the period from February 6, 1984 to February 15, 1984. The boring locations were designated by your field representative. Attached is a sketch indicating the boring locations. We have not included elevations at the boring locations. It is our understanding this information will be supplied by you.

Samples of the soil overburden were obtained at intervals as directed by your field representative. Soil sampling was performed in accordance with ASTM: D 1586-67. Using this procedure, a 2" O.D. split barrel sampler is driven into the soil by a 140 lb weight falling 30". After an initial set of 6", the number of blows required to drive the sampler an additional 12" is known as the penetration resistance or N value. The N value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. Rock core samples were obtained by rotary drilling in accordance with ASTM: D 2113-70.

Barr Engineering Company
February 17, 1984
Page two

As the samples were obtained in the field, they were visually and manually classified by the crew chief in accordance with ASTM: D 2488-69. Representative portions of the samples were then returned to the laboratory for further examination and for verification of the field classification. Logs of the borings indicating the depth and identification of the various strata, the N value, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are attached. Charts illustrating the soil classification procedure, the descriptive terminology and symbols used on the boring logs are also attached.

The results of the test borings are provided on the attached boring logs. A review of these logs indicates a general soil profile of fill, topsoil or swamp deposits underlain by coarse and mixed alluvium. The fill, topsoil or swamp deposits extend to a depth of about 4' and consist of dark colored silty sand silty clay and muck. The coarse alluvial soils are brown sands of varying gradation containing a trace to some gravel. The coarse alluvium extended to the termination depths of borings Q, R and U. Borings S and T contained layers of mixed alluvial soil. This material is a brown and gray lean clay and clayey sand. In boring T, shale was encountered from a depth of about 21' to the termination depth of 30.1'.

It was decided to obtain core samples of the bedrock encountered in boring T. An adjacent boring (T-1) was drilled. No samples were obtained in boring T-1 to a depth of 28.8'. From 28.8' to the termination depth of 60.3', core samples were obtained by means of an NQ wireline system. Core recoveries range from 4% to 100%. The core recoveries are presented on the attached boring log.

A monitoring well was installed in each boring. The monitoring wells were installed in accordance with specifications provided by you and dated January 19, 1984. The details of each installation are illustrated on the attached "Installation of Monitoring Well" sheets.

The monitoring well installed in original boring T became contaminated with grout. The contaminated monitoring well was removed on February 14, 1984. A new monitoring well (T-2) was installed in an adjacent boring located about 2' west of boring T-1. No soil samples were obtained during the drilling of boring T-2.

We appreciate the opportunity to have served you in regards to this project. If you have any questions in regards to the information supplied in this report, please contact us.

Very truly yours,

Patrick G. Francis, C.E.

PGF/rr

Encs.

Proofread by: M. Courteau

LOG OF TEST BORING

JOB NO. 120-11331 VERTICAL SCALE 1" = 5' BORING NO. 0
PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION _____	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	SILTY SAND, fine grained, a trace of gravel, dark brown, moist, frozen to 2' (may be fill) (SM)	FILL OR TOPSOIL			1	HSA				
4	SAND, fine grained, light brown, moist, loose to dense, a few lenses of silty clay and silty clay (SP-SM)	COARSE ALLUVIUM	6		2	SB				
10 1/2	SAND, medium grained, with gravel, brown, moist to 16 1/2' then water-bearing, very dense to dense, a lens of silty sand at about 15' (SP-SM) to (GP-GM)		36		3	SB				
			28	▼	4	SB				
19	SAND, medium grained, a little gravel, brown, waterbearing, dense (SP)		28		5	SB				
24	SAND, medium grained, some gravel, brown, waterbearing dense (SP-SM)		19		6	SB				
27	SAND, fine grained, a trace of gravel, brown, waterbearing, medium dense to dense (SP)		11		7	SB				
36 1/2			25		8	SB				
	End of Boring Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS

START 2-6-84 COMPLETE 2-6-84

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	
2-6	11:40	21 1/2'	19 1/2'		to	16 1/2'	HSA 0-34 1/2'	@ 1:15
2-6	1:15	36 1/2'	34 1/2'		to	NMR		
2-6	2:45	(See Note)			to			
					to			

CREW CHIEF Mishler

LOG OF TEST BORING											
JOB NO		120-11331		VERTICAL SCALE		1" = 5'		BORING NO		R	
PROJECT		GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA									
DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO	TYPE	W	D	LL PL	Qu	
	<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid black; margin-right: 5px;"></div> <div> SURFACE ELEVATION _____ </div> </div>										
	FILL, mostly MUCK, a trace of glass and gravel, black and brown, frozen to 1½'	FILL				1	HSA				
4½	SAND, fine grained, light brown, moist, medium dense, a few lenses of silt (SP-SM)	COARSE ALLUVIUM	9			2	SB				
7½	SAND, medium to fine grained, some gravel, brown, moist, dense (SP-SM)		27			3	SB				
12	SAND, medium grained, some gravel, brown, moist to 12½' then water-bearing, dense (SP)		21			4	SB				
17½	SAND, fine grained, a trace of gravel, brown, waterbearing, loose (SP)		7			5	SB				
23	SAND, fine to medium grained, a little gravel, brown, waterbearing, medium dense (SP)		10			6	SB				
31	End of Boring		14			7	SB				
Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.											

WATER LEVEL MEASUREMENTS							START	2-8-84	COMPLETE	2-9-84
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	HSA 0-29'	@	9:25
2-9	8:50	16'	14'		to	12½'				
2-9	9:25	31'	29'		to	NMR				
2-9	11:30		(See Note)		to					
					to					
							CREW CHIEF	Mishler		

LOG OF TEST BORING

JOB NO. 120-11331 VERTICAL SCALE 1" = 5' BORING NO. S
PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	ORGANIC SILTY CLAY, a trace of gravel, black, frozen to 1½' (may be fill) (OL)	FILL OR SWAMP DEPOSITS			1	HSA				
3½	SAND, fine grained, light brown, moist, loose (SP)	COARSE ALLUVIUM	6		2	SB				
7	SAND, medium grained, a trace of gravel, light brown and brown, moist, medium dense (SP)		10		3	SB				
14½	LEAN CLAY, a little gravel, brown and gray mottled, stiff, a few laminations of sand (CL)	MIXED ALLUVIUM OR TILL	21		4	SB				
17	CLAYEY SAND, a little gravel, brown to gray, stiff to rather stiff, lenses and layers of silty sand and waterbearing sand (SC)		18		5	SB				
26	LEAN CLAY, a little gravel, a few pieces of shale and limestone, gray, very stiff, weathered limestone below about 31.1' (CL)	MIXED ALLUVIUM	12		6	SB				
31.2	Obstruction		50 0.3		7	SB				
	Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS

START 2-7-84 COMPLETE 2-8-84
METHOD HSA 0-31.2' @ 10:25
CREW CHIEF Mishler

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE IN DEPTH	BAILED DEPTHS	WATER LEVEL
2-8	8:50	21½'	19½'		to	21'
2-8	9:20	21½'	19½'		to	18'
2-8	9:30	21½'	19½'		to	17½'
2-8	1:30	(See Note)			to	

LOG OF TEST BORING

JOB NO. 120-11331 VERTICAL SCALE 1" = 5' BORING NO. T
 PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO.	TYPE	W	D	LL PL	QU
	<div> <div> <div></div> <div>SURFACE ELEVATION</div> </div> </div>									
	MUCK, black, frozen to 1½' (may be fill) (Pt)	FILL OR SWAMP DEPOSITS			1	HSA				
3½	SAND, fine grained, light brown, moist, very loose to loose, a few lenses of silty clay and silt (SP)	COARSE ALLUVIUM	3		2	SB				
			7		3	SB				
13	SANDY GRAVEL, with cobbles, brown, moist to 14' then water-bearing, dense (GP-GM)		27	▼	4	SB				
16			0.3							
	CLAYEY SAND, a trace of shale and gravel, a few cobbles, brown and gray, very stiff, some lenses of silty sand and waterbearing sand (SC)	MIXED ALLUVIUM	31		5	SB				
21	SHALE, gray, a few pieces or lenses of limestone	DECORAH FORMATION			6	SB				
			29		7	SB				
			32		8	SB				
30.1	End of Boring									
	Note#1: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									
	Note#2: Monitoring Well removed from boring due to grout contamination of screen.									

WATER LEVEL MEASUREMENTS

START 2-9-84 COMPLETE 2-9-84

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	
2-9	1:50	14.8'	14'		10	14'	HSA 0-28.6'	@ 2:50
2-9	2:50	30.1'	28.6'		10	NMR		
2-10	10:30		(See Note #1)		10			
2-14	10:45		(See Note #2)		10			

CREW CHIEF Mishler

LOG OF TEST BORING

JOB NO 120-11331 VERTICAL SCALE 1" = 5' BORING NO T-1
 PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	NO SAMPLES TAKEN									
28.8	SHALE TO LIMESTONE (All core retained by client)	DECORAH FROMATION TO PLATTE- VILLE FORMATION	46%			NQ				
			4%			NQ				
			42%			NQ				
			47%			NQ				
			70%			NQ				
			100%			NQ				
			82%			NQ				
	Note#1: Boring filled up to depth of 2' with cement/bentonite grout then with native soil to surface		92%			NQ				
	Note#2: Monitoring Well (#T-2) installed in unsampled adjacent boring, located 2' W. See attached "Instal- lation of Monitoring Well" Sheet		98%			NQ				
60.3	End of Boring									

WATER LEVEL MEASUREMENTS

START 2-13-84 COMPLETE 2-13-84

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	TIME
2-13	2:15	60.3'	28.8'		to	NMR	HSA 0-28.8'	@ 2:15
2-14	10:15	60.3'	None		to	(See Note#1)	NQ cored 28.8-60.3'	
2-15	11:00		(See Note#2)		to		CREW CHIEF Mishler	

LOG OF TEST BORING

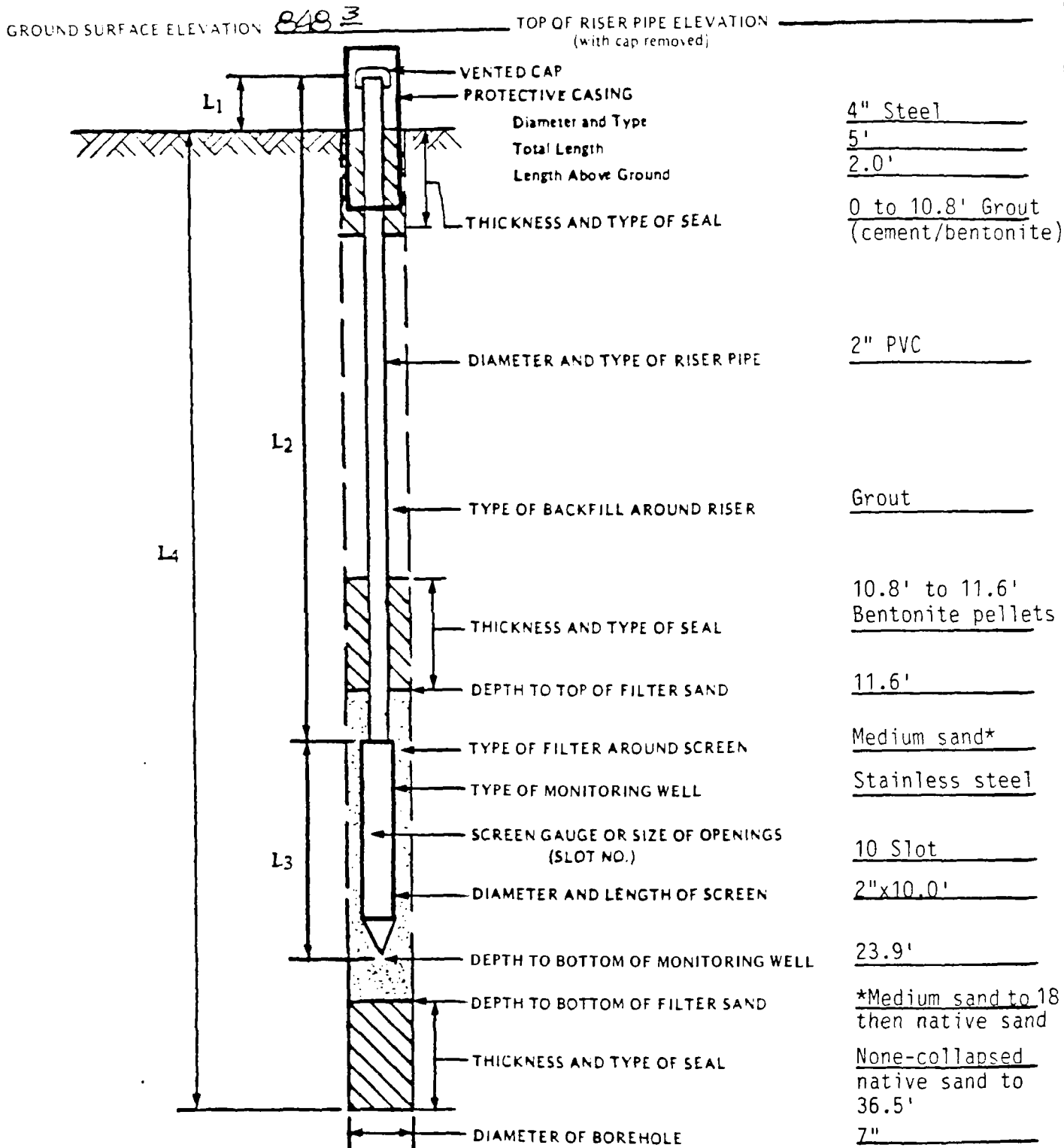
JOB NO 120-11331 VERTICAL SCALE 1" = 5' BORING NO U
PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	↓ SURFACE ELEVATION									
	MUCK, black, frozen to ½' (Pt)	SWAMP DEPOSITS			1	HSA				
4					2	SB				
5	ORGANIC SILTY CLAY, black (See #1) (OH)		6		3	SB				
6	SAND, fine grained, (See #2) (SP-SM)	COARSE ALLUVIUM								
	SANDY GRAVEL, a few cobbles, brown, moist to 14' then waterbearing, very dense (GP-GM)		48		4	SB				
			36		5	SB				
19	SAND, coarse grained, with gravel, a few cobbles, brown, waterbearing, dense (SP-SM)		18		6	SB				
24	SAND, coarse to medium grained, some gravel, brown, waterbearing, medium dense (SP)		14		7	SB				
29	SAND, medium grained, some gravel, brown, waterbearing, dense (SP)		19		8	SB				
32	SAND, fine grained, a trace of gravel, brown, waterbearing, very dense (SP)		31		9	SB				
36	End of Boring									
	#1 - to dark brown, medium (OH)									
	#2 - light brown, moist, loose, a few lenses of silty clay (SP-SM)									
	Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS							START	COMPLETE
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE IN DEPTH	BAILED DEPTHS	WATER LEVEL	2-7-84	2-7-84
2-7	9:40	16'	14'		10	14'	METHOD HSA 0-34' @ 10:35	
2-7	10:35	36'	34'		10	NMR		
2-7	1:20	(See Note)			10		CREW CHIEF Mishler	
					10			

INSTALLATION OF MONITORING WELL

JOB NO. 120-11331 MONITORING WELL NO. 0



$L_1 =$ 2.0 FT

$L_2 =$ 15.9 FT

$L_3 =$ 10.0 FT

$L_4 =$ 36.5 FT

INSTALLATION COMPLETED:

Date 2-6-84 Time 2:45

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

INSTALLATION OF MONITORING WELL

JOB NO. 120-11331 MONITORING WELL NO. R

GROUND SURFACE ELEVATION 841.3 TOP OF RISER PIPE ELEVATION _____
(with cap removed)

VENTED CAP
PROTECTIVE CASING
Diameter and Type 4" Steel
Total Length 5'
Length Above Ground 1.9'
THICKNESS AND TYPE OF SEAL 0 to 6' Grout (cement/bentonite)
DIAMETER AND TYPE OF RISER PIPE 2" PVC
TYPE OF BACKFILL AROUND RISER Grout
THICKNESS AND TYPE OF SEAL 6' to 6.6' Bentonite pellets
DEPTH TO TOP OF FILTER SAND 6.6'
TYPE OF FILTER AROUND SCREEN Medium sand*
TYPE OF MONITORING WELL Stainless steel
SCREEN GAUGE OR SIZE OF OPENINGS (SLOT NO.) 10 slot
DIAMETER AND LENGTH OF SCREEN 2"x10.0'
DEPTH TO BOTTOM OF MONITORING WELL 19.5'
DEPTH TO BOTTOM OF FILTER SAND *Medium sand to 14' then native sand
THICKNESS AND TYPE OF SEAL None-collapsed native sand to 31'
DIAMETER OF BOREHOLE 7"

L₁ = 1.9 FT

L₂ = 11.4 FT

L₃ = 10.0 FT

L₄ = 31 FT

INSTALLATION COMPLETED:

Date 2-9-84 Time 11:30

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

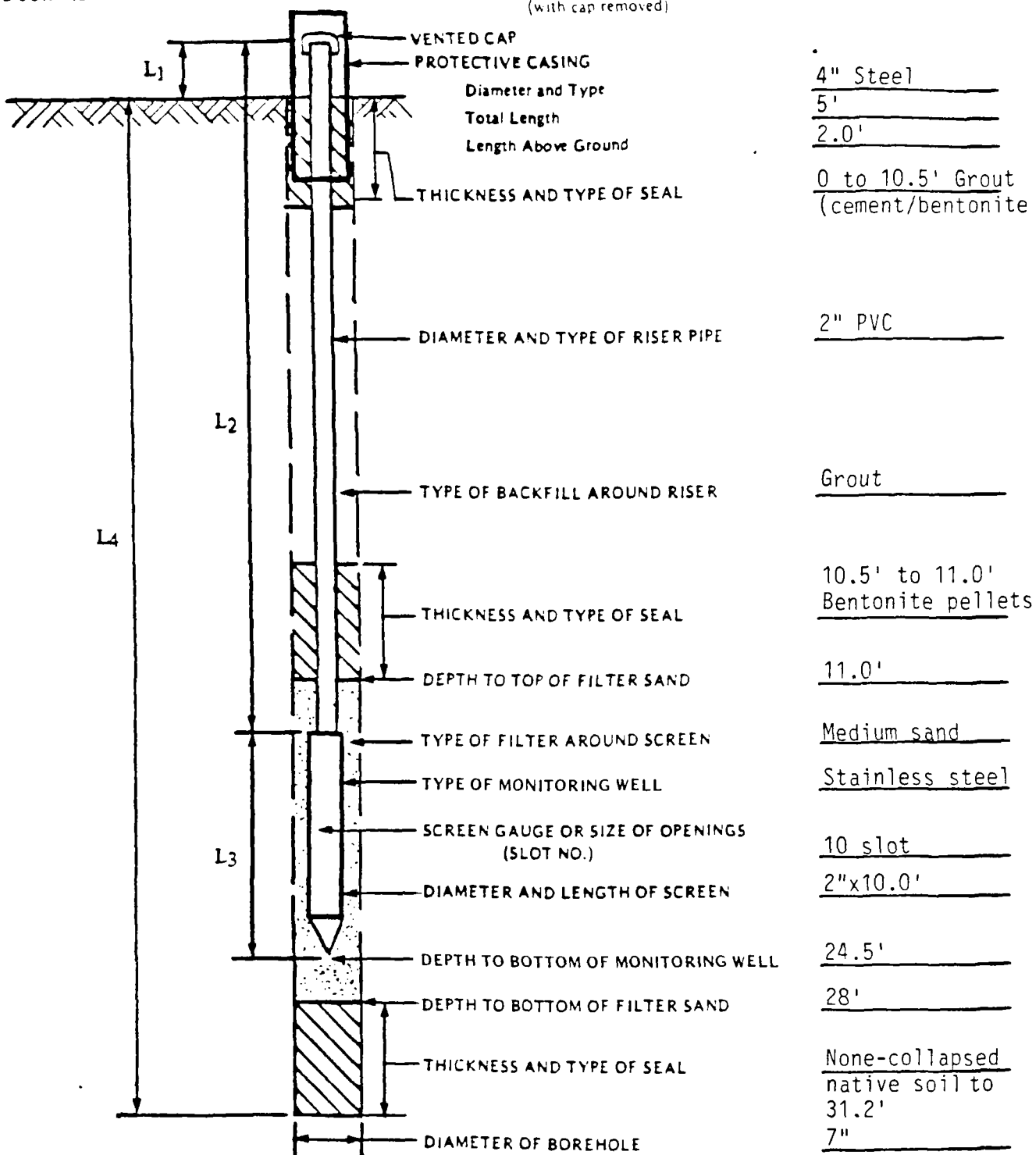
INSTALLATION OF MONITORING WELL

JOB NO. 120-11331

MONITORING WELL NO. S

GROUND SURFACE ELEVATION 846.3

TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 2.0 FT

L₂ = 16.5 FT

L₃ = 10.0 FT

L₄ = 31.2 FT

INSTALLATION COMPLETED:

Date 2-8-84 Time 1:30

MONITORING WELL WATER LEVEL MEASUREMENTS

DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

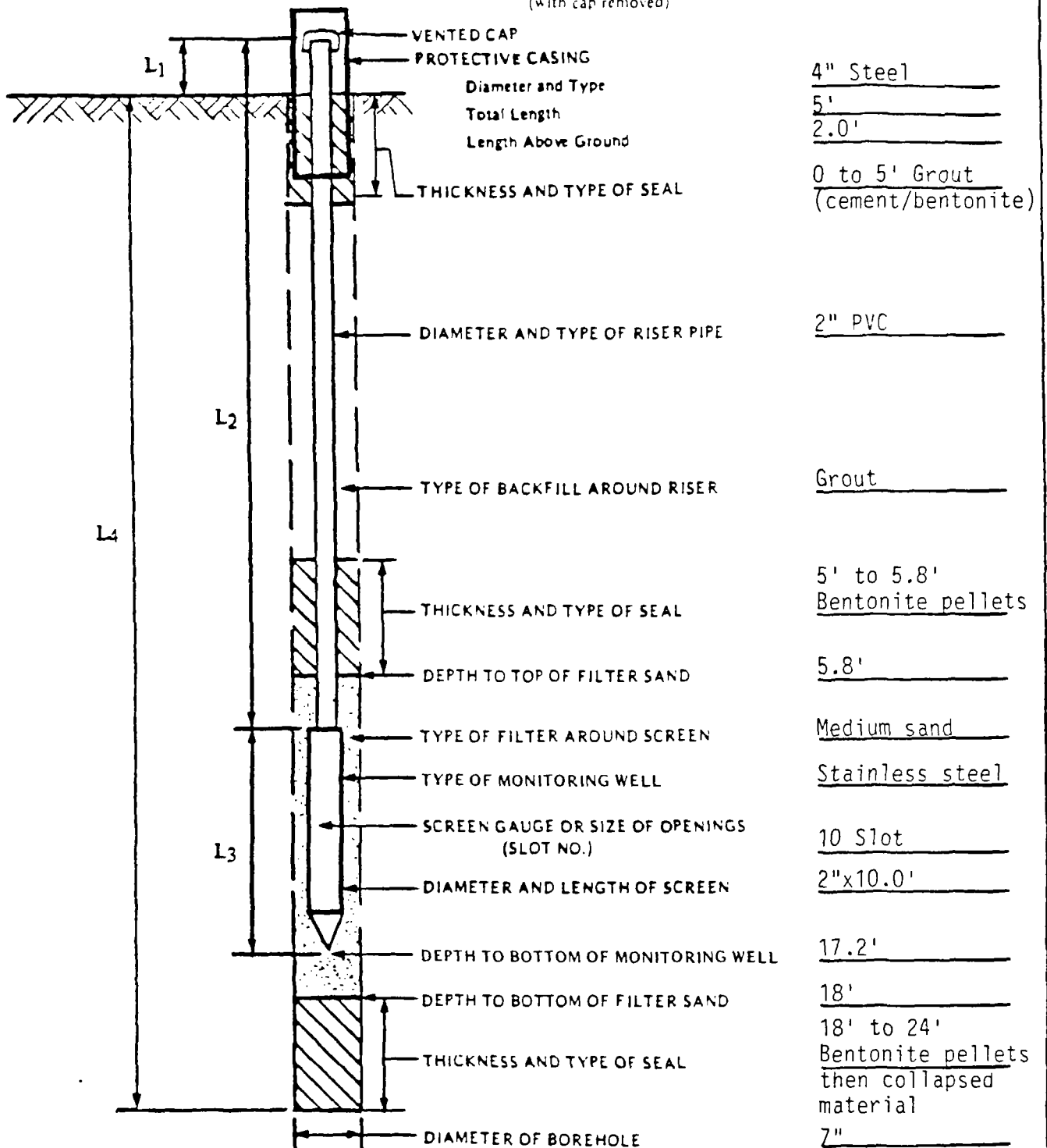
INSTALLATION OF MONITORING WELL

JOB NO. 120-11331

MONITORING WELL NO. T (See Note Below)

GROUND SURFACE ELEVATION

TOP OF RISER PIPE ELEVATION
(with cap removed)



$L_1 = 2.0$ FT

$L_2 = 9.2$ FT

$L_3 = 10.0$ FT

$L_4 = 30.1$ FT

INSTALLATION COMPLETED:

Date 2-10-84 Time 10:30

Note: 2-14-84@10:45 Monitoring Well removed from boring due to grout contamination of screen.

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

INSTALLATION OF MONITORING WELL

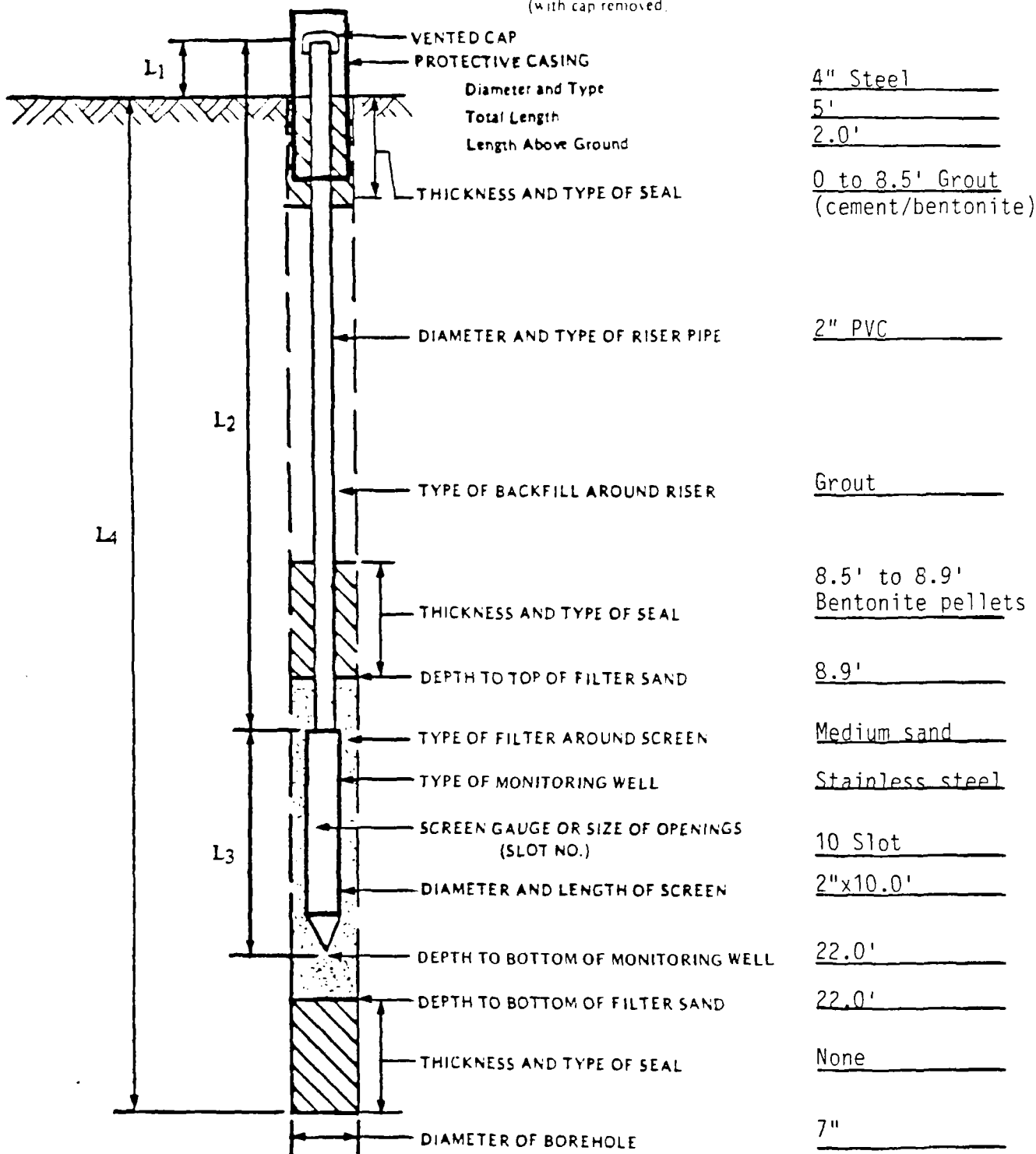
JOB NO. 120-11331

MONITORING WELL NO. T-2

(Installed in unsampled borehole)

GROUND SURFACE ELEVATION 8473

TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 2.0 FT

L₂ = 14.0 FT

L₃ = 10.0 FT

L₄ = 22 FT

INSTALLATION COMPLETED:

Date 2-15-84 Time 11:00

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

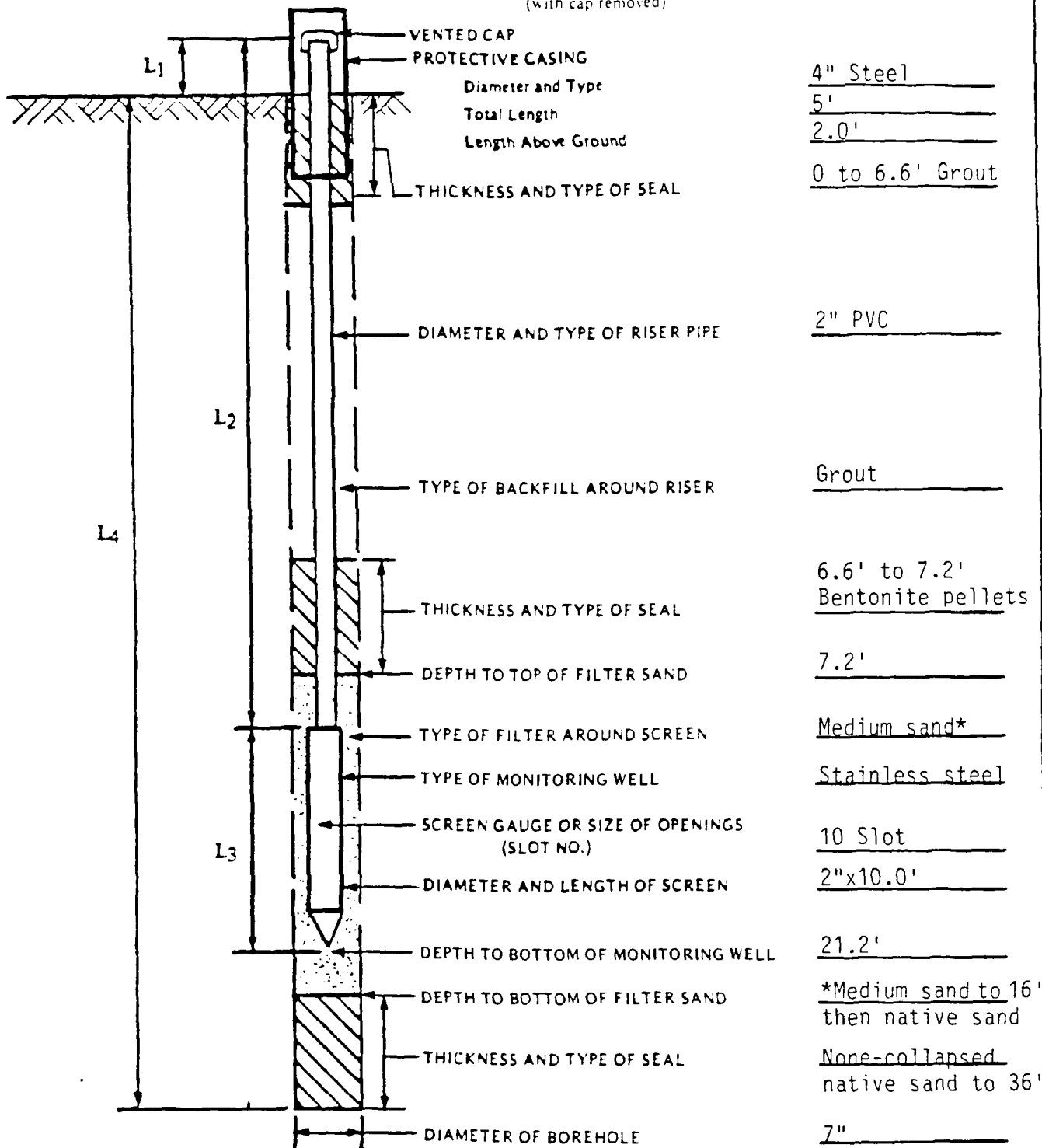
(1) DEPTH BELOW TOP OF RISER PIPE

SOIL EXPLORATION

INSTALLATION OF MONITORING WELL

JOB NO. 120-11331 MONITORING WELL NO. U

GROUND SURFACE ELEVATION 852.5 TOP OF RISER PIPE ELEVATION (with cap removed) _____



L₁ = 2.0 FT

L₂ = 13.2 FT

L₃ = 10.0 FT

L₄ = 36 FT

INSTALLATION COMPLETED:

Date 2-7-84 Time 1:20

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

GENERAL NOTES

DRILLING AND SAMPLING SYMBOLS

SYMBOL	DEFINITION
HSA	3 1/4" I.D. Hollow Stem Auger
FA	4", 6" or 10" Diameter Flight Auger
HA	2", 4" or 6" Hand Auger
DC	2 1/2", 4", 5" or 6" Steel Drive Casing
RC	Size A, B or N Rotary Casing
PD	Pipe Drill or Cleanout Tube
CS	Continuous Split Barrel Sampling
DM	Drilling Mud
JW	Jet Water
SB	2" O.D. Split Barrel Sample
L	2 1/2" or 3 1/2" O.D. SB Liner Sample
T	2" or 3" Thin Walled Tube Sample
3TP	3" TWT (Pitcher Sampler)
TO	2" or 3" TWT (Osterberg Sampler)
W	Wash Sample
B	Bag Sample
P	Test Pit Sample
Q	BQ, NQ or PQ Wireline System
X	AX, BX or NX Double Tube Barrel
CR	Core Recovery - Percent
NSR	No Sample Recovered, classification based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit.
NMR	No Measurement Recorded, primarily due to presence of drilling or coring fluid.
▼	Water Level Symbol

LABORATORY TEST SYMBOLS

SYMBOL	DEFINITION
W	Water Content - % of Dry Wt. - ASTM D 2216
D	Dry Density - Pounds Per Cubic Foot
LL, PL	Liquid and Plastic Limit - ASTM D423 and 424
Qu	Unconfined Compressive Strength - in Pounds/Square Foot - ASTM D 2166
Additional Insertions in Qu Column	
Pq	Penetrometer Reading - Tons/Square Foot
Ts	Torvane Reading - Tons/Square Foot
G	Specific Gravity - ASTM D 854
SL	Shrinkage Limit - ASTM D 427
pH	Hydrogen ion Content - Meter Method
OC	Organic Content - Combustion Method
SP	Swell Pressure - Tons/Square Foot
PS	Percent Swell
FS	Free Swell - Percent
SC	Sulfate Content - Parts/Million, same as mg/L
CC	Chloride Content - Parts/Million, same as mg/L
C *	One Dimensional Consolidation - ASTM D 2435
Qc *	Triaxial Compression
D.S. *	Direct Shear - ASTM D3080
K *	Coefficient of Permeability - cm/sec
D *	Dispersion Test
MA *	Particle Size Analysis - ASTM D 422
R	Laboratory Resistivity, in ohm - cm
E *	Pressuremeter Deformation Modulus - TSF
Vs *	Field Vane Shear - ASTM D 2573
RQD	Rock Quality Designation - Percent

* See attached data sheet or graph

WATER LEVEL

Water levels shown on the boring logs are the levels measured in the borings at the time and under the conditions indicated. In sand, the indicated levels may be considered reliable ground water levels. In clay soil, it may not be possible to determine the ground water level within the normal time required for test borings, except where lenses or layers of more pervious waterbearing soil are present and even then an extended period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed texture soils may not indicate the true level of the ground water table. Perched water refers to water above an impervious layer, thus impeded in reaching the water table. The available water level information is given at the bottom of the log sheet.

DESCRIPTIVE TERMINOLOGY

DENSITY TERM	"N" VALUE	CONSISTENCY TERM	
Very Loose	0-4	Soft	Lamination Up to 1/2" thick stratum
Loose	5-8	Medium	Layer 1/2" to 6" thick stratum
Medium Dense	9-15	Rather Stiff	Lens 1/2" to 6" discontinuous stratum, pocket
Dense	16-30	Stiff	Varved Alternating laminations of clay, silt and/or fine grained sand, or colors thereof
Very Dense	Over 30	Very Stiff	Dry Powdery, no noticeable water
Standard "N" Penetration: Blows Per Foot of a 140 Pound Hammer Falling 30 inches on a 2 inch OD Split Barrel Sampler.			Moist Below saturation
			Wet Saturated, above liquid limit
			Waterbearing Pervious soil below water

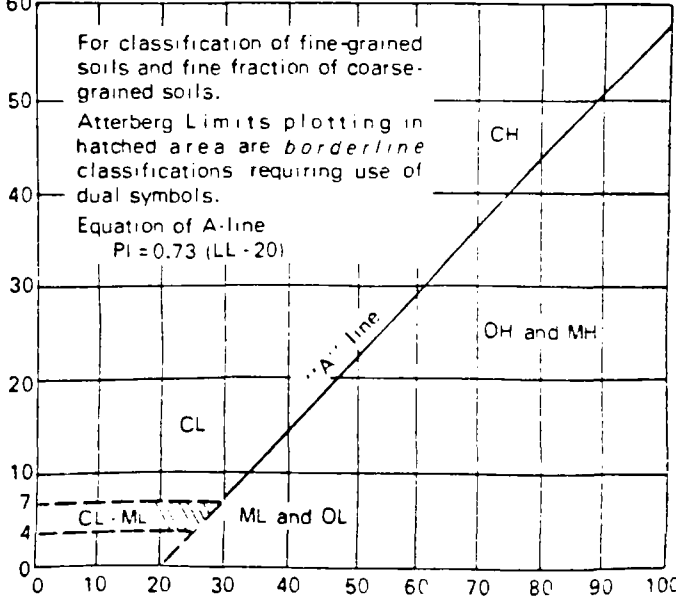
RELATIVE PROPORTIONS AND SIZES

Term	Range	
Trace	0-5%	Boulder Over 12"
A Little	5-15%	Cobble 3" - 12"
Some	15-30%	Gravel
With	30-50%	Coarse 3/4" - 3"
		Fine # 4 - 3/4"
		Sand
		Coarse # 4 - # 10
		Medium # 10 - # 40
		Fine # 40 - # 200
		Silt & Clay - # 200, Based on Plasticity

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

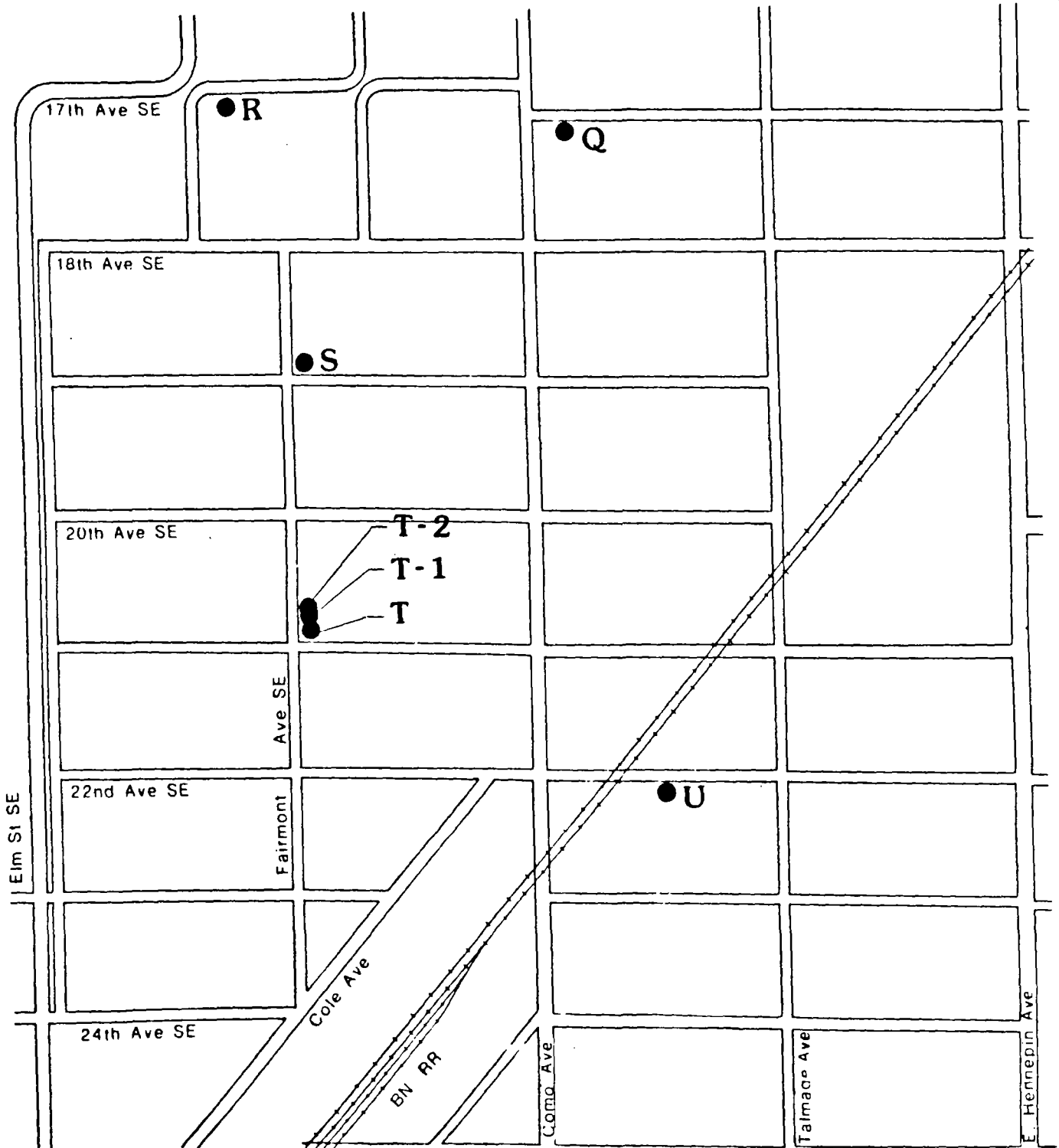
ASTM Designation: D 2487 - 69 AND D 2488 - 69

(Unified Soil Classification System)

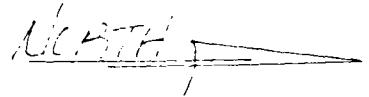
Major divisions			Group symbols	Typical names	Classification criteria		
Coarse-grained soils More than 50% retained on No. 200 sieve*	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve GW, GP, SW, SP More than 12% pass No. 200 sieve GM, GC, SM, SC 5 to 12% pass No. 200 sieve <i>Borderline</i> classifications requiring use of dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4. $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean sands	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6. $C_z = \frac{(D_{30})^2}{D_{10} \times D_{50}}$ between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with fines	SM	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Fine-grained soils 50% or more passes No. 200 sieve*	Silts and clays Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		Plasticity Chart For classification of fine-grained soils and fine fraction of coarse-grained soils. Atterberg Limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols. Equation of A-line $PI = 0.73 (LL - 20)$ 	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
OL			Organic silts and organic silty clays of low plasticity				
Silts and clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts				
		CH	Inorganic clays of high plasticity, fat clays				
		OH	Organic clays of medium to high plasticity				
Highly organic soils		Pt	Peat, muck and other highly organic soils				

*Based on the material passing the 3 in. (76 mm) sieve.

*Based on the material passing the 3 in. (76 mm) sieve.



MONITORING WELL
LOCATIONS



SOIL TEST BORINGS

JOB NO. 120-11331

SCALE: 1" = 400'

DRAWN BY RB

CHECKED BY

COPY



SOIL EXPLORATION
company

662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-6446

March 22, 1984

a sister corporation to TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Barr Engineering Company
6800 France Avenue South
Minneapolis, MN 55435

Attn: Mr. Lawrence D. Dalen

Subject: Soil Borings & Monitoring Well Installations
General Mills Minneapolis Site
Minneapolis, Minnesota
#120-11331-A

OFFICERS:
CHARLES W. BRITZIUS
chairman of the board
NORMAN E. HENNING
president
ROBERT F. WITTMAN
executive vice president
CLINTON R. EUE
secretary/treasurer

HOME OFFICE:
ST. PAUL, MN

OFFICES IN:
MANKATO, MN
ROCHESTER, MN
WAITE PARK, MN

Gentlemen:

We have completed the soil borings and monitoring well installations for the above referenced project. This work was conducted in accordance with authorization we received on February 29, 1984.

All of the soil samples recovered from the test borings will be held at this office for 30 days after the completion date of this report. We will then contact you as to their disposition.

The test boring and monitoring well installations were conducted during the period from March 7, 1984 to March 12, 1984. The boring locations were designated by your field representative. Attached is a sketch indicating the boring locations. We have not included elevations at the boring locations. It is our understanding this information will be supplied by you.

Samples of the soil were obtained at intervals as directed by your field representative. Soil sampling was performed in accordance with ASTM: D 1586-67. Using this procedure, a 2" O.D. split barrel sampler is driven into the soil by a 140 lb weight falling 30". After an initial set of 6", the number of blows required to drive the sampler an additional 12" is known as the penetration resistance or N value. The N value is an index of the relative density of cohesionless soils and the consistency of cohesive soils.

As the samples were obtained in the field, they were visually and manually classified by the crew chief in accordance with ASTM: D

Barr Engineering Company
March 22, 1984
Page two

2488-69. Representative portions of the samples were then returned to the laboratory for further examination and for verification of the field classification. Logs of the borings indicating the depth and identification of the various strata, the N value, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are attached. Charts illustrating the soil classification procedure, the descriptive terminology and symbols used on the boring logs are also attached.

The results of the test borings are provided on the attached boring logs. A review of these logs indicates a general soil profile of fill underlain by fine alluvium, coarse alluvium and glacial till. The fill is mostly dark colored silty sand containing some organic silty clay, muck and clayey sand. The depth of fill varies from about 1' in boring W to about 8' in boring Z. About 2½' of muck was encountered immediately beneath the existing fill in boring X. The coarse alluvial soils are predominantly brown sands of varying gradation containing a little gravel and a few cobbles. The coarse alluvial soils extend to the termination depths of borings W and X. No coarse alluvial soils were encountered in boring Z. Fine alluvial soils were encountered in borings Y and Z. These soils are mostly gray silty clay and silt. Glacial till was encountered near the termination depths of borings V and Z. The till is sandy clay and clayey sand containing a little gravel.

A monitoring well was installed in each boring. The monitoring wells were installed in accordance with "Specifications for Monitoring Well Installations at General Mills Minneapolis Site" dated January 19, 1984, and prepared by Barr Engineering Company. The details of each installation are illustrated on the attached "Installation of Monitoring Well" sheets.

We appreciate the opportunity to have served you in regards to this project. If you have any questions in regards to the information supplied in this report, please contact us.

Very truly yours,

Patrick G. Francis, C.E.

PGF/rr

Encs.

Proofread by: M. Courteau

LOG OF TEST BORING

JOB NO. 120-11331-A VERTICAL SCALE 1" = 5' BORING NO. V
 PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	↓ SURFACE ELEVATION _____									
	FILL, mixture of ORGANIC SILTY CLAY and SILTY SAND, a little gravel, black, frozen to 1½'	FILL			1	HSA				
4½										
5½	SILTY SAND, fine grained(See#1)(SM)	COARSE ALLUVIUM			2	SB				
	SAND, fine to medium grained, light brown, moist, medium dense (SP)		12		3	SB				
9	SAND, medium to fine grained, a little gravel, light brown, moist, dense (SP)		24		4	SB				
13	SAND, medium grained, some gravel, a layer of gravel at about 13-14' a few cobbles, grayish brown, moist to about 18½' then waterbearing, very dense to dense to very dense(SP)		38		5	SB				
			23		6	SB				
			16		7	SB				
	Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.		39		8	SB				
33	SANDY CLAY, a little gravel, a few pieces of gray shale, a few cobbles, brownish gray, very stiff(See#2)(CL)	TILL	88		9	SB				
35.7	End of Boring		0.7							
	#1 - light brown, moist, medium dense (SM)									
	#2 - a few lenses of silty sand (CL)									

WATER LEVEL MEASUREMENTS

START 3-7-84 COMPLETE 3-8-84

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	HSA 0-34½'	@ 9:20
3-7	4:40	21½'	20'		10	18.5'			
3-8	8:10	21½'	20'	19.8'	10	18.6'			
3-8	9:20	35.7'	34½'		10	NMR			
3-8	11:00	(See Note)			10				

CREW CHIEF LeMay

LOG OF TEST BORING

JOB NO 120-11331-A VERTICAL SCALE 1" = 5' BORING NO W
 PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION _____	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
1	FILL, mostly ORGANIC (See#1)	FILL			1	HSA				
	SILTY SAND, medium to coarse grained, with gravel, some cobbles and boulders, brown and grayish brown, dry to moist, frozen to 3' then very dense (SM-GM)	COARSE ALLUVIUM	55		2	HSA				
					3	HSA				
					4	SB				
8	SAND, medium to coarse grained, some gravel, a few cobbles, brown, moist to about 9½' then waterbearing, very dense (SP-SM)		52		5	SB				
14	SANDY GRAVEL, with cobbles and boulders, grayish brown, water- bearing, very dense (GP-GM)		75 0.5		6	SB				
			107		7	SB				
20.5	End of boring (Obstruction with HSA at 20.0') #1 - SILTY CLAY, a little gravel, black, frozen Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS

START 3-7-84 COMPLETE 3-7-84

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	
3-7	10:25	15.0'	14½'		10	12.2'	HSA 0-20.0'	@ 11:50
3-7	11:50	20.5'	20.0'	20.2'	10	9.3'		
3-7	12:50	20.5'	20.0'		10	9.3'		
3-7	3:40		(See Note)		10			

CREW CHIEF LeMay

LOG OF TEST BORING

JOB NO. 120-11331-A VERTICAL SCALE 1" = 5' BORING NO. X
 PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION _____	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	FILL, mixture of SILTY SAND and MUCK, black, frozen to 1½'	FILL			1	HSA				
4	MUCK, brown and dark brown, soft (Pt)	SWAMP DEPOSITS	4		2	SB				
6½	SILTY SAND, fine grained, grayish brown, moist, medium dense (SM-SP)	COARSE ALLUVIUM			3	SB				
8½	SAND, medium grained, some gravel, a few slabs and pieces of limestone, brown, moist to 11½' then water-bearing, dense (SP-SM)		23	▼	4	SB				
			23		5	SB				
19	SAND, medium to fine grained, a trace of gravel, a cobble at about 20½', brown, waterbearing, dense (SP)		50 0.6		6	SB				
24	SAND, medium grained, a trace of gravel, brown, waterbearing, dense (SP)		27		7	SB				
27	End of Boring Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS

START 3-8-84 COMPLETE 3-8-84

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	@
3-8	11:55	16'	14½'		10	11.6'	HSA 0-25'	1:30
3-8	12:55	16'	14½'		10	11.9'		
3-8	1:30	27'	19'	18.6'	10	11.6'		
3-8	3:00	(See Note)			10			

CREW CHIEF LeMay

LOG OF TEST BORING

JOB NO. 120-11331-A VERTICAL SCALE 1" = 5' BORING NO. Y
PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
2	SILTY SAND, black, moist (may be fill) (SM)	FILL OR TOPSOIL			1	HSA				
4	SILTY SAND, fine grained, light grayish brown, moist (SM-SP)	COARSE ALLUVIUM			2	HSA				
	SAND, fine to medium grained, light brown, moist, medium dense (SP)		9		3	SB				
9	SAND, medium grained, a little gravel, light brown and brown, moist to about 15½' then waterbearing, medium dense, a lens of black sand at about 15½' (SP)		10		4	SB				
			12	▼	5	SB				
					6	SB				
18	SAND, medium grained, a little to some gravel, gray, waterbearing, very dense to dense (SP)		32		7	SB				
			22		8	SB				
29½	SILT, gray, wet, dense (ML)	FINE ALLUVIUM	17		9	SB				
30½	FAT CLAY, gray, stiff (CH)				10	SB				
31½	End of Boring									
	Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-9	1:55	16½'	14½'		to	15.3'
3-9	2:05	16½'	14½'		to	15.4'
3-9	2:40	31½'	29½'		to	15.9'
3-9	2:50	31½'	23'	22.8'	to	15.4'
3-12	11:00	31½'	23'	22.3'	to	15.9'
3-12	1:00		(See Note)		to	
					to	
					to	

START 3-9-84 COMPLETE 3-9-84

METHOD HSA 0-29½' @ 2:40

CREW CHIEF LeMay

LOG OF TEST BORING

JOB NO. 120-11331-A VERTICAL SCALE 1" = 5' BORING NO. Z
 PROJECT GENERAL MILLS MINNEAPOLIS SITE - MINNEAPOLIS, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION _____	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
	FILL, mixture of SILTY SAND, SAND and CLAYEY SAND, a little gravel, brown, dark brown and a little black, frozen to 1'	FILL			1	HSA				
			3		2	SB				
8	SILTY CLAY, gray, medium, a few lenses of clayey silt and silt (CL)	FINE ALLUVIUM	7		3	SB				
					4	SB				
			8		5	SB				
					6	SB				
18½	SANDY SILT, brown to grayish brown, wet, dense (ML)				7	SB				
20	SILT, gray, wet, dense to medium dense, a few lenses of silty clay, clayey silt and wet to waterbearing sand (ML)		26	▼	8	SB				
			9		9	SB				
					10	SB				
30	SANDY CLAY, a little gravel, gray, stiff (CL)	TILL	16		11	SB				
32	CLAYEY SAND, a little gravel, brownish gray, rather stiff, a few lenses of sandy clay (SC)				12	SB				
			10		13	SB				
36½	End of Boring Note: Monitoring Well installed in boring. See attached "Installation of Monitoring Well" sheet.									

WATER LEVEL MEASUREMENTS							START	COMPLETE
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	3-8-84	3-9-84
3-9	8:45	21'	19½'	20½'	to	None	METHOD HSA 0-34½' @ 9:50	
3-9	9:05	26½'	24½'	26'	to	24.3'		
3-9	9:20	26½'	24½'	26'	to	22.2'	CREW CHIEF LeMay	
3-9	9:50	36½'	29'	34'	to	26.8'		
3-9	12:20	(See Note)						

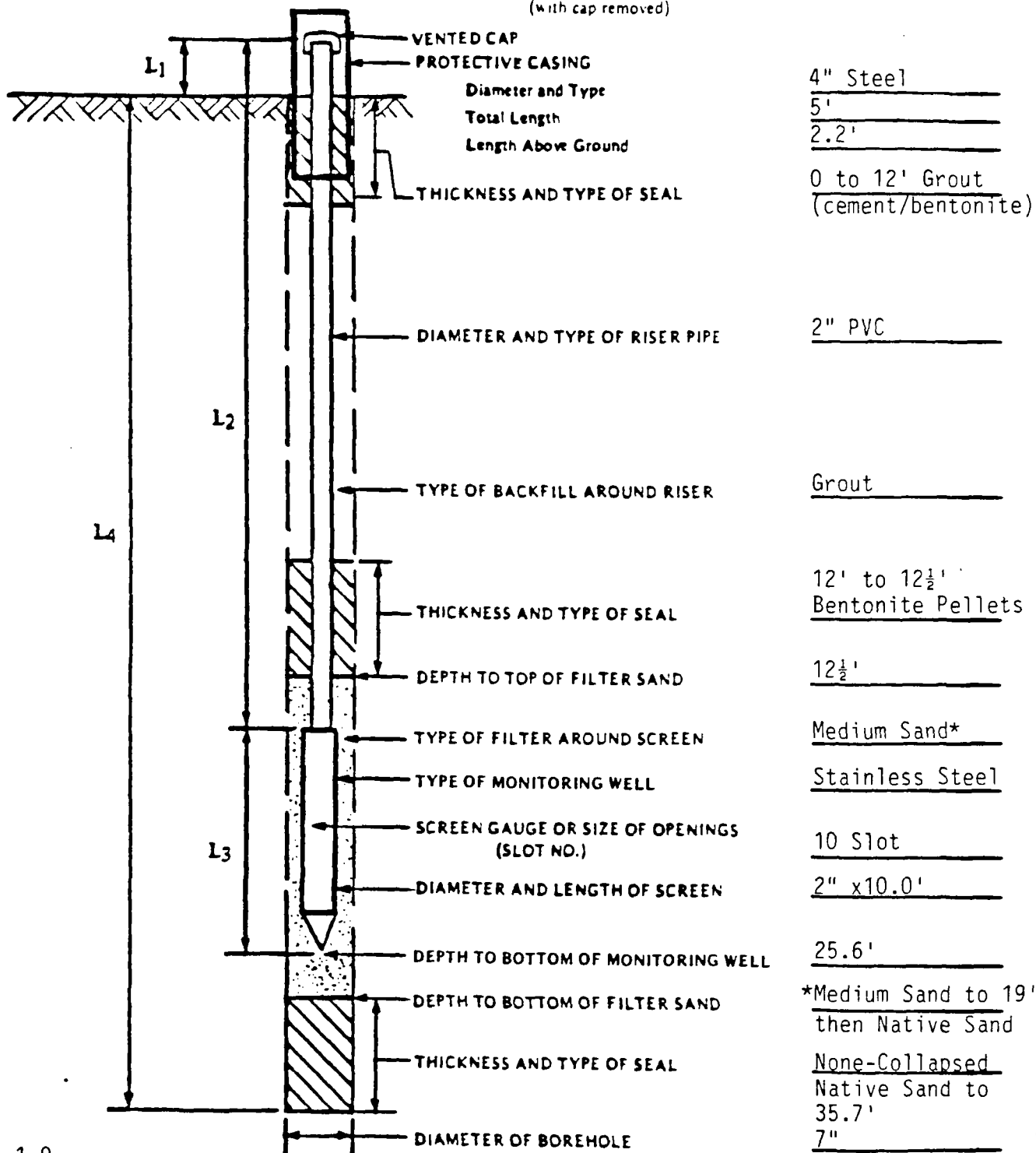
INSTALLATION OF MONITORING WELL

JOB NO. 120-11331-A

MONITORING WELL NO. V

GROUND SURFACE ELEVATION

TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 1.9 FT

L₂ = 17.5 FT

L₃ = 10.0 FT

L₄ = 35.7 FT

INSTALLATION COMPLETED:

Date 3-8-84 Time 11:00

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

SOIL EXPLORATION

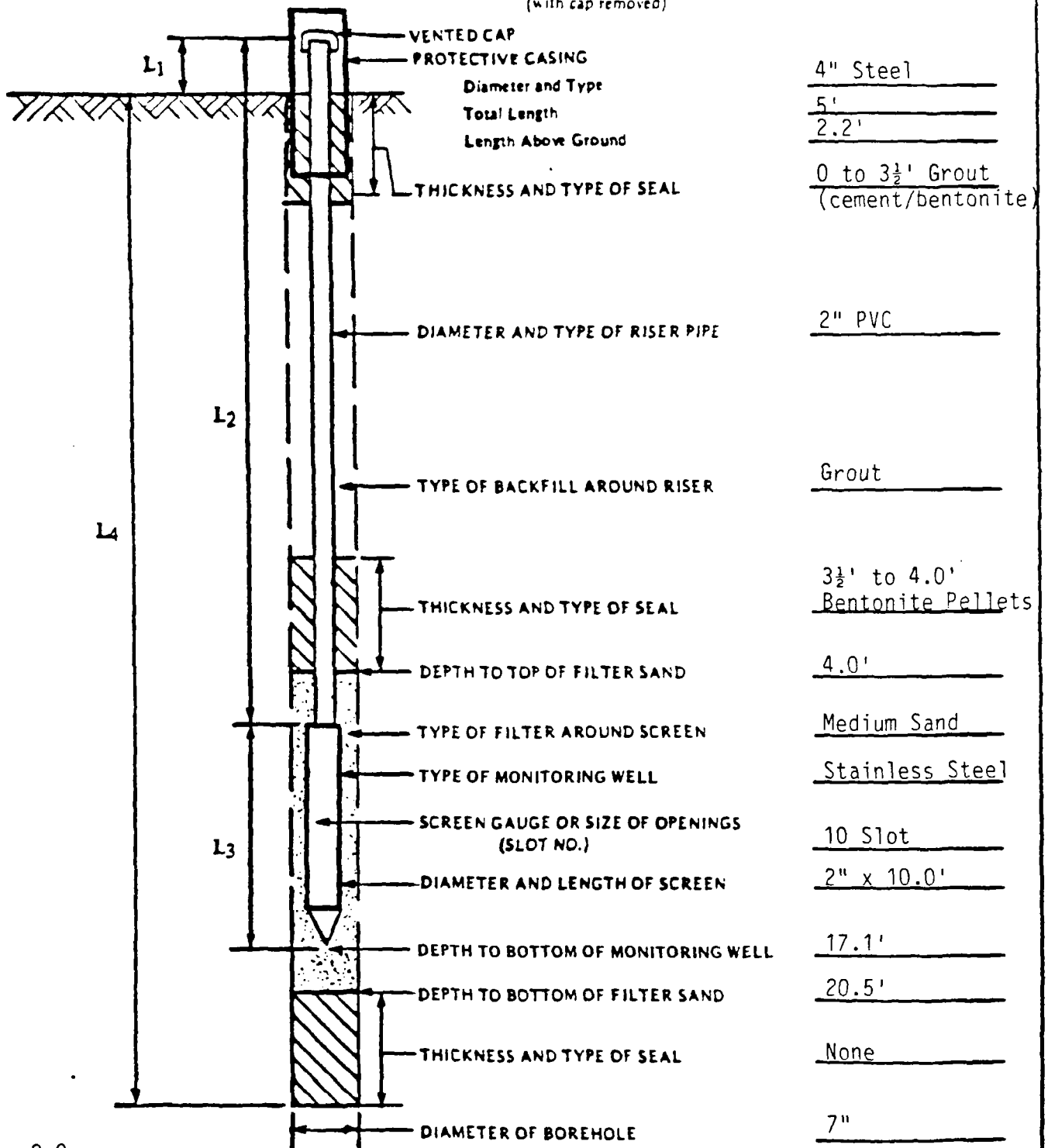
INSTALLATION OF MONITORING WELL

JOB NO. 120-11331-A

MONITORING WELL NO. W

GROUND SURFACE ELEVATION

TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 2.0 FT

L₂ = 9.1 FT

L₃ = 10.0 FT

L₄ = 20.5 FT

INSTALLATION COMPLETED:

Date 3-7-84 Time 3:40

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)
3-8-84	8:00		11.5'

(1) DEPTH BELOW TOP OF RISER PIPE

SOIL EXPLORATION

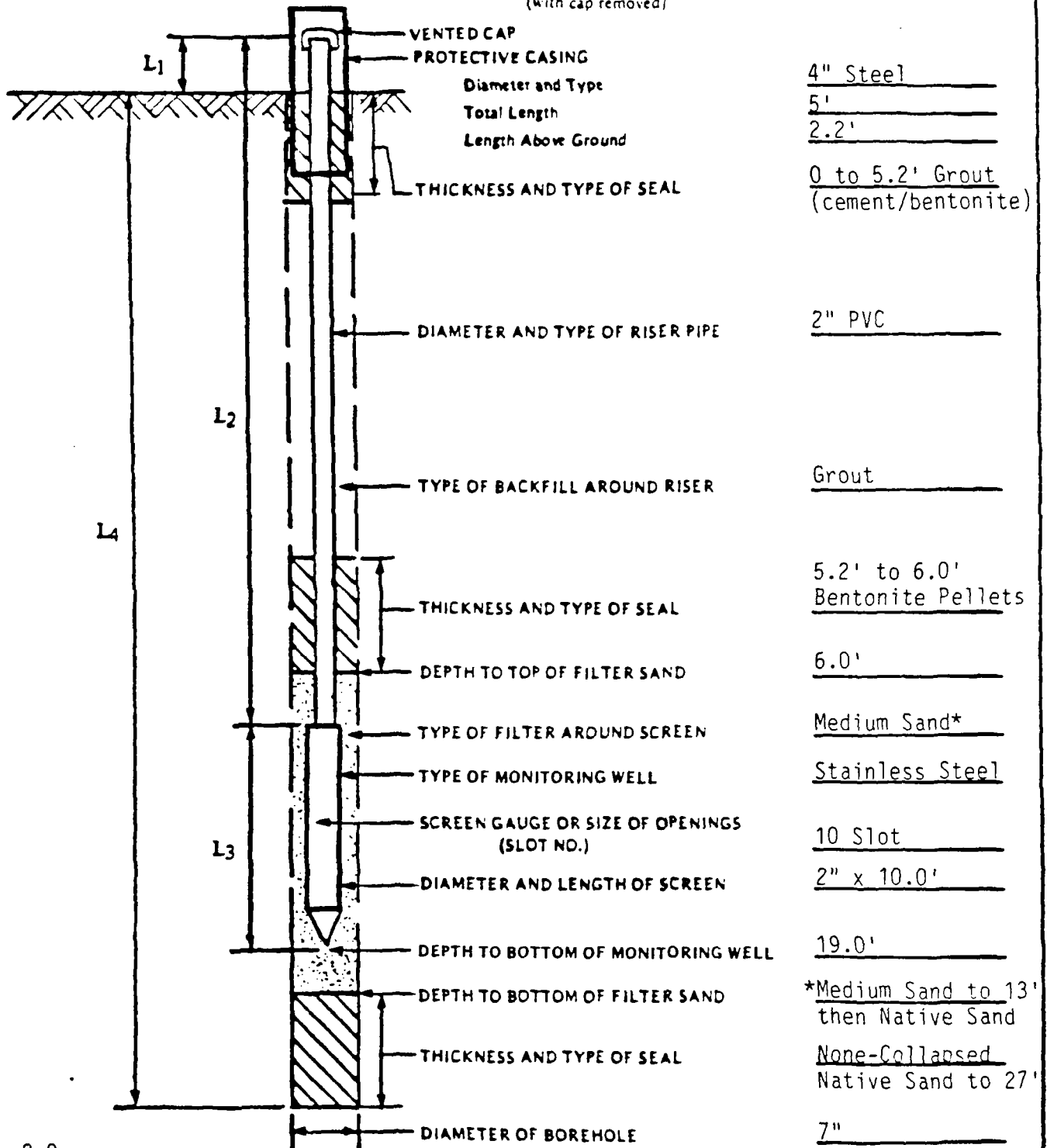
INSTALLATION OF MONITORING WELL

JOB NO. 120-11331-A

MONITORING WELL NO. X

GROUND SURFACE ELEVATION

TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 2.0 FT

L₂ = 11.0 FT

L₃ = 10.0 FT

L₄ = 27 FT

INSTALLATION COMPLETED:

Date 3-8-84 Time 3:00

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

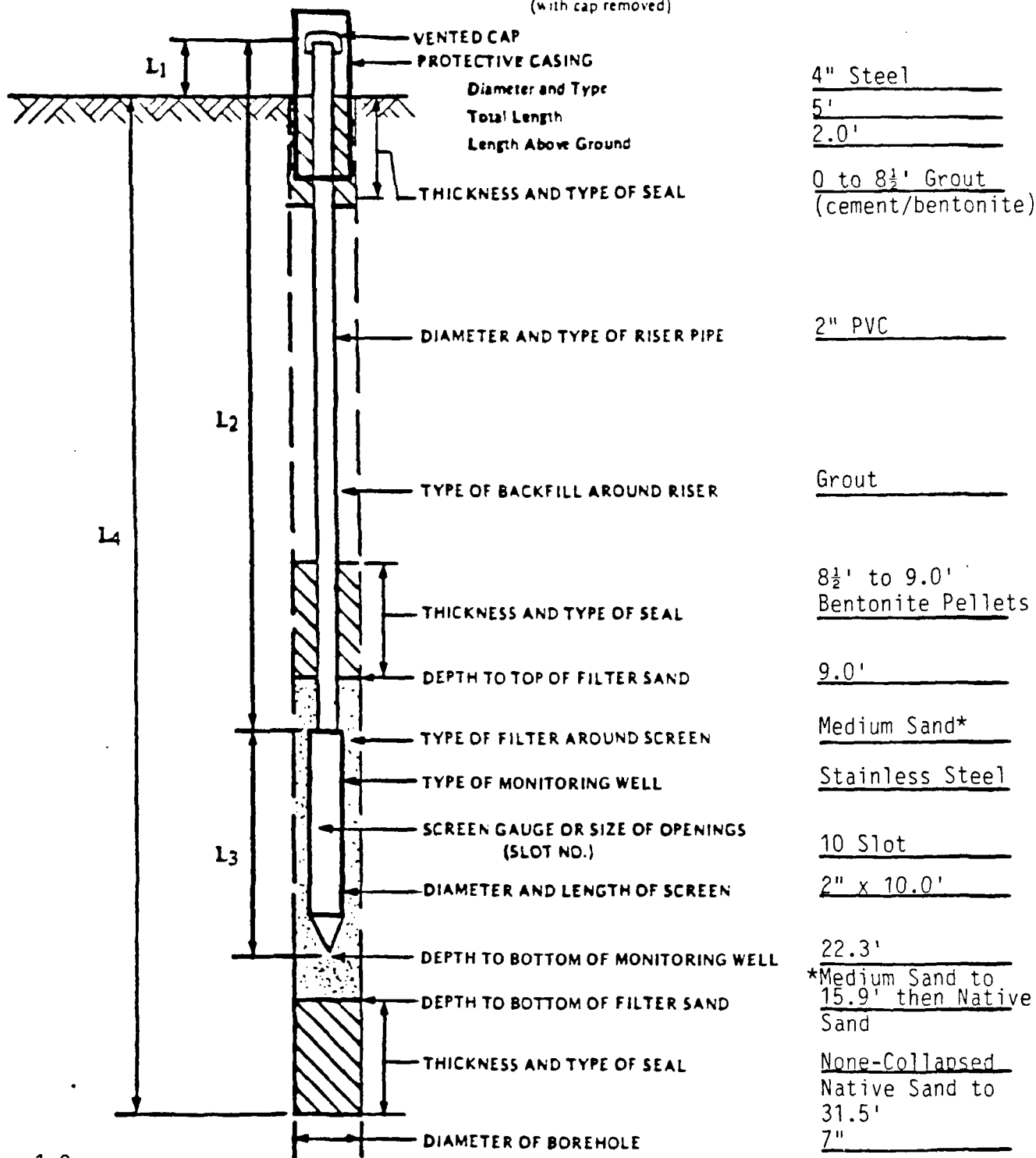
SOIL EXPLORATION

INSTALLATION OF MONITORING WELL

JOB NO. 120-11331-A

MONITORING WELL NO. Y

GROUND SURFACE ELEVATION TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 1.9 FT

L₂ = 14.2 FT

L₃ = 10.0 FT

L₄ = 31.5 FT

INSTALLATION COMPLETED:

Date 3-12-84 Time 1:00

MONITORING WELL WATER LEVEL MEASUREMENTS

DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

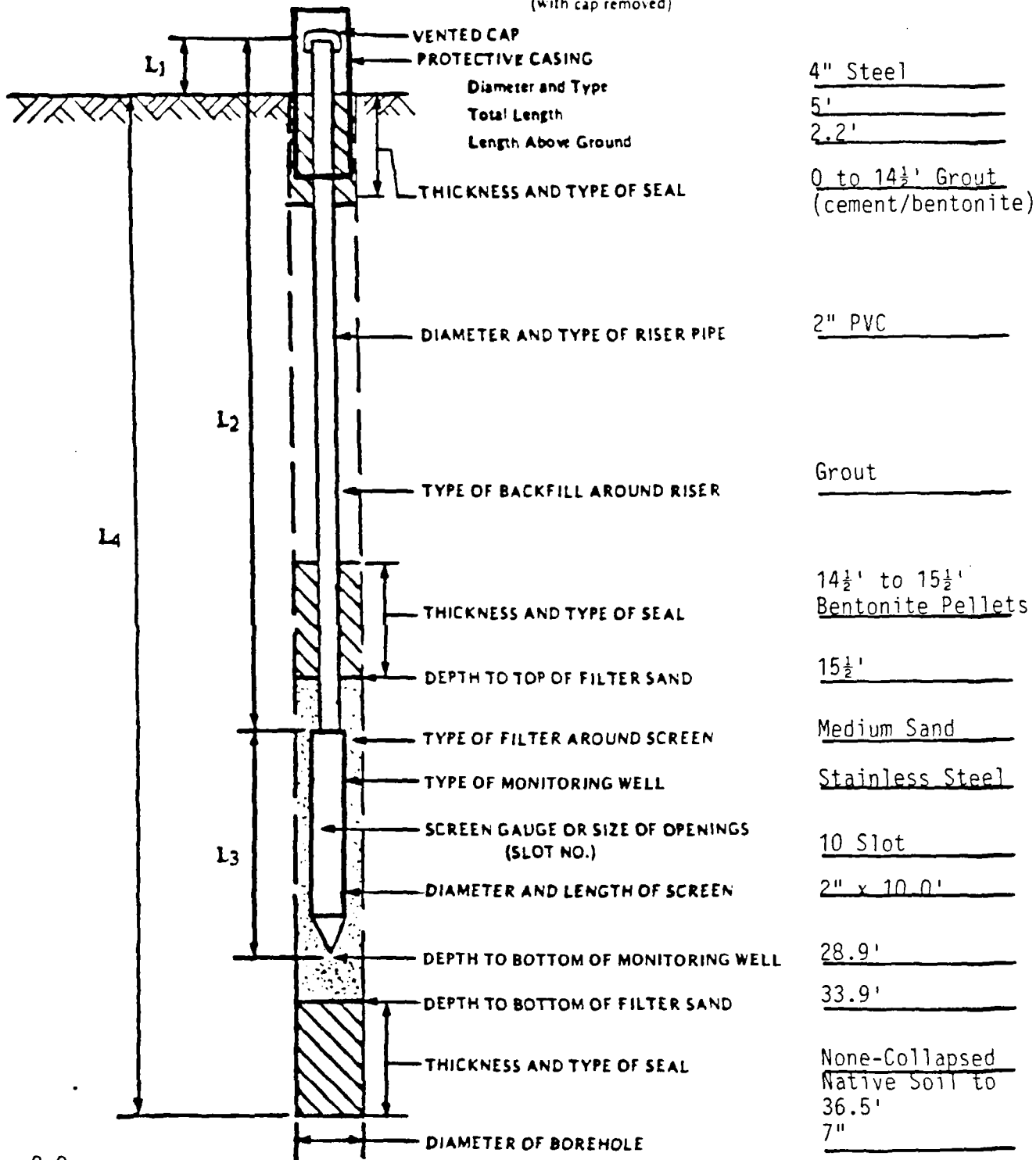
INSTALLATION OF MONITORING WELL

JOB NO. 120-11331-A

MONITORING WELL NO. 7

GROUND SURFACE ELEVATION

TOP OF RISER PIPE ELEVATION
(with cap removed)



L₁ = 2.0 FT

L₂ = 20.9 FT

L₃ = 10.0 FT

L₄ = 36.5 FT

INSTALLATION COMPLETED:

Date 3-9-84 Time 12:20

MONITORING WELL WATER LEVEL MEASUREMENTS

DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)

(1) DEPTH BELOW TOP OF RISER PIPE

GENERAL NOTES

DRILLING AND SAMPLING SYMBOLS

SYMBOL	DEFINITION
HSA	3 1/4" I.D. Hollow Stem Auger
_FA	4", 6" or 10" Diameter Flight Auger
_HA	2", 4" or 6" Hand Auger
_DC	2 1/2", 4", 5" or 6" Steel Drive Casing
_RC	Size A, B or N Rotary Casing
_PD	Pipe Drill or Cleanout Tube
CS	Continuous Split Barrel Sampling
DM	Drilling Mud
JW	Jet Water
SB	2" O.D. Split Barrel Sample
_L	2 1/2" or 3 1/2" O.D. SB Liner Sample
_T	2" or 3" Thin Walled Tube Sample
3TP	3" TWT (Pitcher Sampler)
_TO	2" or 3" TWT (Osterberg Sampler)
W	Wash Sample
B	Bag Sample
P	Test Pit Sample
_Q	BQ, NQ or PQ Wireline System
_X	AX, BX or NX Double Tube Barrel
CR	Core Recovery - Percent
NSR	No Sample Recovered, classification based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit.
NMR	No Measurement Recorded, primarily due to presence of drilling or coring fluid.
▼	Water Level Symbol

LABORATORY TEST SYMBOLS

SYMBOL	DEFINITION
W	Water Content - % of Dry Wt. - ASTM D 2216
D	Dry Density - Pounds Per Cubic Foot
LL, PL	Liquid and Plastic Limit - ASTM D423 and 424
Qu	Unconfined Compressive Strength - in Pounds/Square Foot - ASTM D 2166
Additional Insertions in Qu Column	
Pq	Penetrometer Reading - Tons/Square Foot
Ts	Torvane Reading -Tons/Square Foot
G	Specific Gravity - ASTM D 854
SL	Shrinkage Limit - ASTM D 427
pH	Hydrogen ion Content - Meter Method
OC	Organic Content - Combustion Method
SP	Swell Pressure - Tons/Square Foot
PS	Percent Swell
FS	Free Swell - Percent
SC	Sulfate Content - Parts/Million, same as mg/L
CC	Chloride Content - Parts/Million, same as mg/L
C *	One Dimensional Consolidation - ASTM D 2435
Qc *	Triaxial Compression
D.S. *	Direct Shear - ASTM D3080
K *	Coefficient of Permeability - cm/sec
D *	Dispersion Test
MA *	Particle Size Analysis - ASTM D 422
R	Laboratory Resistivity, in ohm - cm
E *	Pressuremeter Deformation Modulus - TSF
Vs *	Field Vane Shear - ASTM D 2573
RQD	Rock Quality Designation - Percent

* See attached data sheet or graph

WATER LEVEL

Water levels shown on the boring logs are the levels measured in the borings at the time and under the conditions indicated. In sand, the indicated levels may be considered reliable ground water levels. In clay soil, it may not be possible to determine the ground water level within the normal time required for test borings, except where lenses or layers of more pervious waterbearing soil are present and even then an extended period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed texture soils may not indicate the true level of the ground water table. Perched water refers to water above an impervious layer, thus impeded in reaching the water table. The available water level information is given at the bottom of the log sheet.

DESCRIPTIVE TERMINOLOGY

DENSITY TERM	"N" VALUE	CONSISTENCY TERM	
Very Loose	0-4	Soft	Lamination Up to 1/2" thick stratum
Loose	5-8	Medium	Layer 1/2" to 6" thick stratum
Medium Dense	9-15	Rather Stiff	Lens 1/2" to 6" discontinuous stratum, pocket
Dense	16-30	Stiff	Varved Alternating laminations of clay, silt and/or fine grained sand, or colors thereof
Very Dense	Over 30	Very Stiff	Dry Powdery, no noticeable water
Standard "N" Penetration: Blows Per Foot of a 140 Pound Hammer Falling 30 inches on a 2 inch OD Split Barrel Sampler.			Moist Below saturation
			Wet Saturated, above liquid limit
			Waterbearing Pervious soil below water

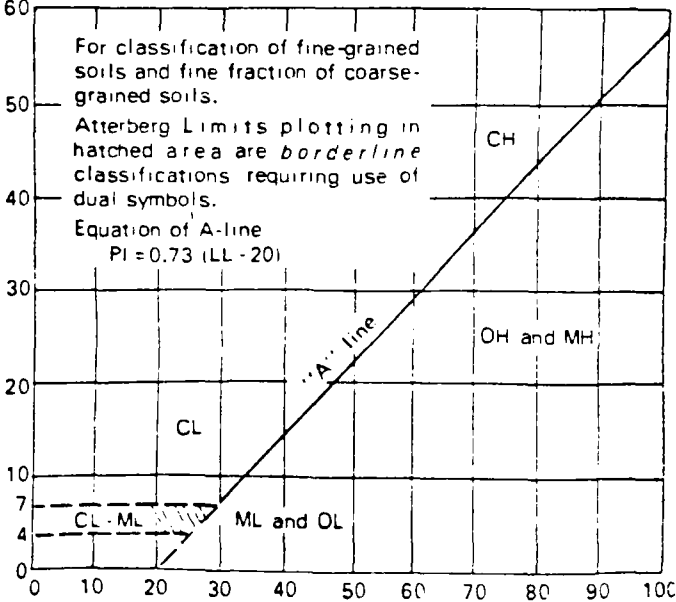
RELATIVE PROPORTIONS AND SIZES

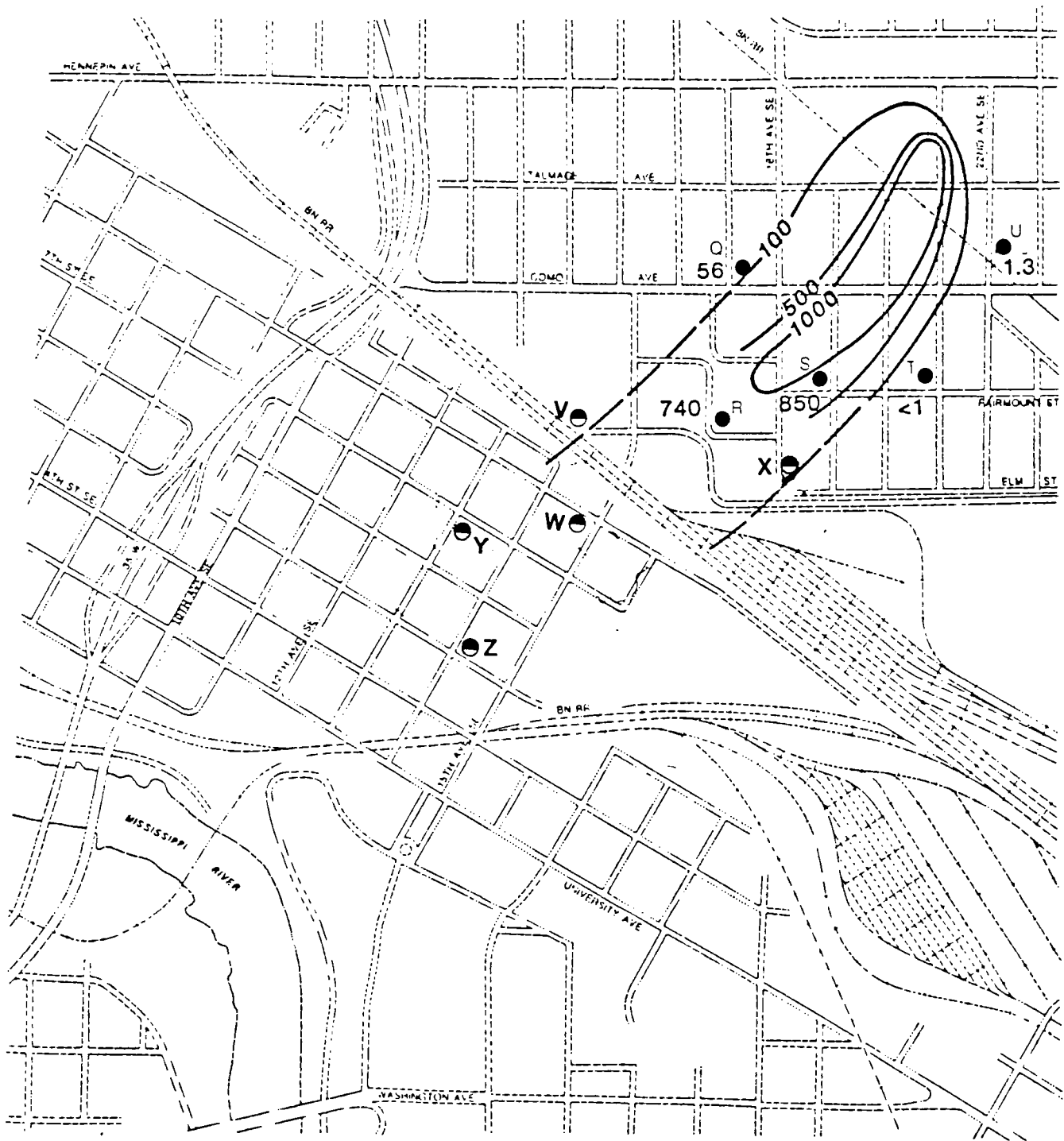
Term	Range	
Trace	0-5%	Boulder Over 12"
A Little	5-15%	Cobble 3" - 12"
Some	15-30%	Gravel
With	30-50%	Coarse 3/4" - 3"
		Fine # 4 - 3/4"
		Sand
		Coarse # 4 - # 10
		Medium # 10 - # 40
		Fine # 40 - # 200
		Silt & Clay - # 200, Based on Plasticity

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation: D 2487 - 69 AND D 2488 - 69

(Unified Soil Classification System)

Major divisions			Group symbols	Typical names	Classification criteria			
Coarse grained soils More than 50% retained on No. 200 sieve*	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve GW, GP, SW, SP More than 12% pass No. 200 sieve GM, GC, SM, SC 5 to 12% pass No. 200 sieve <i>Borderline</i> classifications requiring use of dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4. $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW		
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols	
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7		
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean sands	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6. $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW		
		Sands with fines	SM	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols	
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7		
	Fine-grained soils 50% or more passes No. 200 sieve*	Silts and clays Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		Plasticity Chart  <p>For classification of fine-grained soils and fine fraction of coarse-grained soils, Atterberg Limits plotting in hatched area are <i>borderline</i> classifications requiring use of dual symbols. Equation of A-line $PI = 0.73 (LL - 20)$</p>		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
OL			Organic silts and organic silty clays of low plasticity					
Silts and clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts					
		CH	Inorganic clays of high plasticity, fat clays					
		OH	Organic clays of medium to high plasticity					
Highly organic soils		Pt	Peat, muck and other highly organic soils					
					*Based on the material passing the 3 in. (76 mm) sieve.			



- EXISTING SHALLOW MONITORING WELL
- NEW SHALLOW MONITORING WELL

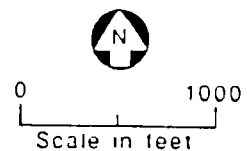


Figure 1
SUMMATION OF VOLATILE ORGANICS
IN SHALLOW GROUNDWATER
(ug/L)

120-11321-A

SOIL exploration
company

for Water Sample

191905

1 LOCATION OF WELL

County Name

Township Name

Distance and direction from Road Intersections or Street Address and City of Well Location

2 FORMATION LOG

3 PROPERTY OWNER'S NAME

4 WELL DEPTH (completed)

5 CASING

6 USE

7 SCREEN

8 STATIC WATER LEVEL

9 PUMPING LEVEL (below land surface)

10 WELL HEAD COMPLETION

11 WELL GROUTED?

12 NEAREST SOURCES OF POSSIBLE CONTAMINATION

13 PUMP

STATE OF MINNESOTA

DEPARTMENT OF HEALTH

MINNESOTA UNIQUE WELL NO.

191905

WATER WELL RECORD

for Water Sample

Minnesota Statutes 156A.111-118

City of Minneapolis

350 S 5th St

Mpls, MN

29 S 22 W 19

885 21st Ave SE 90ft w of 21st Ave North Side

WELL #13

TOP SOIL

SANDY CLAY

COARSE GRAVEL

SHALE

LIMEROCK

BROKEN LIME

HARD LIME

MIX

MIX

GREEN

GREY

GREY

0

3

3

15

15

23

23

46.5

46.5

48

48

49.5

49.5

50

50

3.5

10

At least 12' above grade

Yes

No

Not installed

Model Number

HP

Volts

Length of drop pipe

ft. capacity

g.p.m.

Material of drop pipe

Type

1 Submersible

2 Jet

3 L.S. Turbine

4 Centrifugal

5 Reciprocating

6

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6

15 REMARKS. ELEVATION SOURCE OF DATA. #16

WELL DRILLED FOR BARR ENGINEERING CO, INC.
6800 France Ave S
Mr Larry Dalen 920 0655
Mpls permit # 237

lipls permit # 237

16 WATER WELL CONTRACTOR'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

~~E.H. RENNER & SONS, INC 02015~~

Address 6300 Industry Ave NW ANOKA MN 55303

Signed Koppe E. Kasser Date 26 MAR 84
Authorized Representative

1. LOCATION OF WELL

STATE OF MINNESOTA

DEPARTMENT OF HEALTH

MINNESOTA UNIQUE WELL NO

WATER WELL RECORD

for Water Sample

191906

County Name

HENNEPIN

Township Name

MPLS

Township Number

29

Range Number

22

Section No

19

Tract

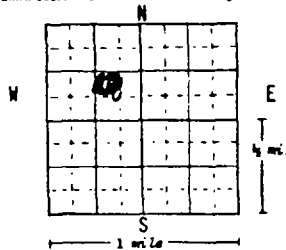
nw ne nw

Distance and direction from Road Intersections of Street Address and City of Well Location

885 21st Ave Se 55ft w of 21st Ave-North Side

Show exact location of well on section grid with "X"

Sketch map of well location



Addition Name

Block Number

Lot Number

WELL = ZZ

3. PROPERTY OWNER'S NAME

CITY OF MINNEAPOLIS
350 S 5th St
Mpls, MN

4. WELL DEPTH (completed)

56.5

Date of Completion

22 MAR 84

5. ☒ Hand test ☐ Reverse ☐ Driven ☐ Plug

☐ Hollow rod ☐ Air ☐ Bored ☐ _____

☐ Rotary ☐ Jetted ☐ Power Auger

6. USE

☐ Domestic ☐ Public Supply ☐ Industry

☐ Irrigation ☐ Municipal ☐ Commercial

☒ Test Well ☐ Air Conditioning ☐ _____

7. CASING

☒ Black ☐ Threaded ☐ HEAVY Above/Show

☐ Galv ☒ Welded Surface 1.83 ft.

☐ Plastic ☐ Drive Shoe* Yes ☒ No

4 in. to 51.5 ft. Weight 11 lbs/ft.

8 in. to 47.5 ft. Weight 28 lbs/ft.

8 in. to 56.5 ft. Weight 18 lbs/ft.

8. SCREEN

Make _____ Or open hole from 51.5 ft to 56.5 ft.

Type _____ Dia. _____

Slot/Gauge _____ Length _____

Set between _____ ft. and _____ ft.

_____ ft. and _____ ft.

9. STATIC WATER LEVEL

_____ ft. below land surface ☐ above land surface Date Measured _____

10. PUMPING LEVEL (below land surface)

_____ ft. after 3 hrs pumping 10 g.p.m.

_____ ft. after _____ hrs pumping _____ g.p.m.

11. WELL HEAD COMPLETION

☐ Pitless adapter manufacturer _____ model _____

☐ Basement offset ☐ At least 12" above grade

12. WELL GROUTED?

☒ Yes ☐ No

☒ Neat Cement ☐ Bentonite ☐ _____

Grout material cement from 47.5 to (2.5) ft Cu Yds 1.17

13. NEAREST SOURCES OF POSSIBLE CONTAMINATION

_____ feet _____ direction _____ type

Well disinfected upon completion* Yes ☐ No ☐

14. PUMP

Date installed _____ ☒ Not installed

Manufacturer's Name _____

Model Number _____ HP _____ Volts _____

Length of drop pipe _____ ft. capacity _____ g.p.m.

Material of drop pipe _____

Type ☐ Submersible ☐ L. S. Turbine ☐ Reciprocating

☐ Jet ☐ Centrifugal ☐ _____

16. WATER WELL CONTRACTOR'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

E.H. RENNER & SONS, INC

02015

Licensee Business Name

License No.

Address 6300 Industry Ave NW ANOKA, MN 55303

Signed Roger E. Renner Date 26 MAR 84

DARRELL OWEN2

Date 26 MAR 84

Name of Driller

1-4 2014

15. REMARKS ELEVATION, SOURCE OF DATA, etc

WELL DRILLED FOR BARR ENGINEERING CO, INC.
6800 France Ave S Mpls, MN
Mr Larry Dalen #920 0655

Mpls permit #239

Use a second sheet, if needed